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TRANSFORMING THE FORCE: A COMPARATIVE ANALYSIS OF THE DEPARTMENT OF DEFENSE'S (DOD'S) ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS

by

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Automated Information Systems (AIS) are Software systems that support administrative functions, such as accounting, payroll, finance, personnel, inventory control, logistics, and equipment and maintenance scheduling. An ERP system is a type of AIS that works to integrate all the different functional business areas of an organization. Since the 1990s, a large number of corporations have transitioned from legacy proprietary software to an ERP. The companies who have successfully made the transition have greatly benefited from the flow of information across the organization that is brought about by the ERP's ability to integrate the multi-dimensional data into a single common database. The current AIS environment of the DOD is marked by a lack of systems integration. Like industry, the DOD is looking to combat this environment with ERP systems. This thesis intends to document the history of the ERP implementations in the DOD. In addition, this thesis will highlight the different approaches each service is taking to complete their transitions. The thesis will also compare the plans of the services to the plans that successful corporations executed in their transitions to an ERP. By comparing the plans of the services to industry's guidelines on how to correctly implement an ERP, this thesis will provide new analysis to aid the DOD in this critical endeavor.

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TRANSFORMING THE FORCE: A COMPARATIVE ANALYSIS OF THE DEPARTMENT OF DEFENSE'S (DOD'S) ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS

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ABSTRACT

Automated Information Systems (AIS) are Software systems that support administrative functions, such as accounting, payroll, finance, personnel, inventory control, logistics, and equipment and maintenance scheduling. An ERP system is a type of AIS that works to integrate all the different functional business areas of an organization. Since the 1990s, a large number of corporations have transitioned from legacy proprietary software to an ERP. The companies who have successfully made the transition have greatly benefited from the flow of information across the organization that is brought about by the ERP's ability to integrate the multi-dimensional data into a single common database. The current AIS environment of the DOD is marked by a lack of systems integration. Like industry, the DOD is looking to combat this environment with ERP systems. This thesis intends to document the history of the ERP implementations in the DOD. In addition, this thesis will highlight the different approaches each service is taking to complete their transitions. The thesis will also compare the plans of the services to the plans that successful corporations executed in their transitions to an ERP. By comparing the plans of the services to industry's guidelines on how to correctly implement an ERP, this thesis will provide new analysis to aid the DOD in this critical endeavor.

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LIST OF ACRONYMS

AIS	Automated Information Systems
ALMAR	All Marine Message
AMC	Army Material Command
ASN RDA	Assistant Secretary of the Navy for Research, Development, and Acquisition
ATLASS I	Asset Tracking, Logistics, and Supply System
BCA	Business Case Analysis
BOM	Bill of Material
BPR	Business Process Reengineering
BSM	Business System Modernization
BTA	Business Transformation Agency
CBP	Commercial Business Practices
CCSS	Commodity Command Standard System
CDA	Central Design Activity
CECOM	Communications-Electronics Command
CFO	Chief Financial Officer
CIO	Chief Information Officer
COBOL	Common Business Oriented Language
CONUS	Continental United States
COO	Chief Operating Officer
COTS	Commercial-off-the-shelf
CRM	Customer Relationship Management
CSC	Computer Sciences Corporation
CSS R/R	Combat Service Support Rename/Reorganize
CWT	Customer Wait Time
C2	Command and Control
DLA	Defense Logistics Agency
DOD	Department of Defense
DON	Department of the Navy
DPMS	Distribution Planning and Management System
DRI	Defense Reform Initiative
DRMO	Defense Reutilization and Marketing Office
DRMS	Defense Reutilization and Marketing Service
ECSS	Expeditionary Combat Support System
EDI	Electronic Data Interchange
EDS	Electronic Data Systems Corporation
EFDS	Expeditionary Force Development System
EOM	Echelons of Maintenance
ERP	Enterprise Resource Planning
ESI	Enterprise Software Initiative
FAS	Fuels Automated System
FFMIA	Federal Financial Management Improvement Act of 1996

FOC	Full Operational Capability
FSSG	Force Service Support Group
GAO	U.S. Government Accountability Office
GCSS-AF	Global Combat Support System-Air Force
GCSS-Army	Global Combat Support System-Army
GCSS-MC	Global Combat Support System-Marine Corps
GE	General Electric
GOTS	Government-off-the-shelf
GSA	General Services Administration
GSP	Global Stock Positioning
IDE	Integrated Data Environment
IOC	Initial Operating Capability
IS	Information Services
ISMS	Integrated Subsistence Management System
ITMRA	Information Technology Management Reform Act
ITV	In-Transit Visibility
JEDMICS	Joint Engineering Data Management Information and Control System
LCM	Logistics Chain Management
LMP	Logistics Modernization Program
Log EA	Logistics Enterprise Architecture
Log IR	Logistics Information Resource
Log Mod	Logistics Modernization
Log OA	Logistics Operational Architecture
MAGTF	Marine Air-Ground Task Force
MDM	Master Data Management
MEB	Modernization Executive Board
MEF	Marine Expeditionary Force
MIMMS	Marine Corps Integrated Maintenance Management System
MRE	Meal Ready to Eat
MRP	Material Requirements Planning
MRP II	Manufacturing Resource Planning
NAVAIRSYSCOM	Naval Air Systems Command
NAVSEASYSCOM	Naval Sea Systems Command
NAVSUPSYSCOM	Naval Supply Systems Command
NCA	National Command Authority
NFFE	National Federation of Federal Employees
NIMS	National Inventory Management Strategy
NWCF	Navy Working Capital Fund
OCONUS	Outside the Continental United States
OMB	Office of Management and Budget
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
PDMI	Product Data Management Initiative
PLM	Product Lifecycle Management

PLM+	Product Lifecycle Management Plus
PMO	Program Management Office
POM	Program Objective Memorandum
QDR	Quadrennial Defense Review
R&D	Research and Development
RBA	Revolution in Business Affairs
RFID	Radio Frequency Identification
RICE	Reports, Interfaces, Conversions, Enhancements
RMP	Reutilization Modernization Program
ROI	Return on Investment
ROM	Realignment of Maintenance
ROS	Realignment of Supply
R/3	Release 3
S&OP	Sales & Operations Planning
SALE	Single Army Logistics Enterprise
SAMMS	Standard Automated Material Management System
SASSY	Supported Activities Supply System
SCA	Supply Chain Alliances
SCM	Supply Chain Management
SDS	Standard Depot System
SECDEF	Secretary of Defense
SGL	Standard General Ledger
SPR	Strategic Petroleum Reserve
SRM	Supplier Relationship Management
SSC-SD	Space and the Naval Warfare Systems Support Center San Diego
SYSCOM	Systems Command
TAV	Total Asset Visibility
TCO	Total Cost of Ownership
TDD	Time Definite Delivery
TTF	Transition Task Force
UI	User Interface
USD/AT&L	Under Secretary of Defense for Acquisition, Technology, and Logistics
WLMP	Wholesale Logistics Modernization Program
Y2K	Year 2000

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I. INTRODUCTION

A. BACKGROUND

During the 1990s, Presidents George H. W. Bush and Bill Clinton recognized that the efficiency of government's business processes and information systems had fallen drastically behind the processes and systems that were being used in the private sector. To overcome the gap, the heads of state began to push toward the adoption of private industries' business processes and systems via legislation. The first target for transformation was the government's financial management systems.

In 1990, the Chief Financial Officers (CFO) Act was passed and 24 executive branch officials were established and charged with the modernization of the financial management systems of the major U.S. Departments. These included the Department of Defense (DOD), the Department of Commerce, the Department of Energy, the Environmental Protection Agency, the National Science Foundation, the Nuclear Regulatory Commission, etc. The goal of the CFO Act is for the government agencies to generate financial statements that resemble the statements produced by private companies.

The CFO Act of 1990 was followed by the Federal Financial Management Improvement Act of 1996 (FFMIA) which built upon the CFO Act and recommended government agencies employ Automated Information Systems (AIS) capable of producing reliable, useful, and timely information to improve decision making and accurately maintain accountability of government funds down to the transaction level [1]. In 1996, all of the agencies addressed by the FFMIA knew that systems capable of delivering this type of information could not be found within the government. Thus, they turned to the commercial sector's key technologies to comply with the FFMIA [1].

Also passed in 1996 was the Information Technology Management Reform Act (ITMRA). The ITMRA resulted in the establishment of a DOD Chief Information Officer who was charged with managing the department's investment's in information technology assets [2]. It is a position that is mirrored in the commercial sector and exists

to ensure that all technology purchases are aligned to ensure interoperability and contribute to the strategy of the organization.

It is clear from the wording of the legislation passed and the positions that were created in the early to mid 1990s, that the government was looking to industry for answers as to how IT would renew its business processes and financial information systems. From industry, the answer would come in the form of configurable information systems known as Enterprise Resource Planning systems (ERPs).

B. CURRENT AIS ENVIRONMENT OF THE DOD

The pressure to renovate the business processes and systems of the DOD brought about by legislation is external to the department itself. There is additional internal pressure for change coming from the military leadership because of the operational pain of using antiquated processes and information systems.

While the civilian leadership was mainly concerned with accurately tracking dollars in the early 1990s, the military leadership was focusing on business processes because of the logistical problems they experienced in the first Gulf War. A hallmark of that engagement was that the units that were in need of supplies could not get them in a timely and efficient manner. The problem with the logistical pipeline did not stem from a lack of equipment in the area of operations; rather, the problem resulted from an inability to identify and distribute the massive amounts of equipment in a timely manner [3].

At the time of the first Gulf War, the trend in commercial logistics was streamlining supply chains, however, the DOD was not a part of this trend. Instead, the DOD opted for the mass inventory supply methodology which meant that everything that might possibly be used was sent into theater. Once there, the processes for getting the supplies to those in need were complex within the individual services and there was virtually no interoperability between the services. The end result was pallets of unused equipment awaiting return to the U.S. at the end of the war. Upon seeing the consequences of the mass inventory approach, the Generals in charge coined the phrase “iron mountains” to describe the stacked rows of cargo boxes filled with unused equipment and supplies. The “iron mountains” and a failure to support troops on the field

of battle troubled the DOD leadership. It was decided then that the DOD had to change the way it performed Supply Chain Management (SCM).

The first step in the DOD's SCM transformation was the identification of the root causes of the "iron mountains." Investigating the causes led to the determination that the ineffectiveness of the DOD's supply chains was the result of two problems: obsolete supply chain management policies and outdated information systems that supported those policies. Both problems would need to be remedied to move the logistical capabilities of the DOD closer to the capabilities of the commercial sector [3]. Adding to the problems that needed to be overcome, there was also the civilian leadership's FFMIA requirement that the DOD produce auditable financial records.

Traditionally, the DOD had looked to in-house programmers to write the code for business system software [4]. Yet, by the time the causes of the "iron mountains" were defined in the mid 1990s, the environment surrounding the DOD had changed. The Federal Acquisition Streamlining Act (1994) and Federal Acquisition Reform Act (1996) had been signed by President Clinton. This legislation reduced the amount of oversight for contracts with the private sector thereby encouraging outsourcing to the commercial sector. Moreover, in the Quadrennial Defense Review of 1997, Clinton's Secretary of Defense (SECDEF) William Cohen directed the DOD to accept the business practices of industry to shape the business process changes that needed to take place in the department. Due to the fact that approval for the funding for the SCM and financial systems transformation projects would have to go through the SECDEF's office, the military leadership took Cohen's command to heart and went to the private sector to explore the options on how the modernization objectives could be met. Industry presented two options: develop custom software that meets the requirements or use ERP software. The first option was deemed impractical because of cost and the nature of the DOD. Developing custom software is a solution that is reserved for organizations looking for the competitive advantage that a custom logistics software suite can provide [4]. This customization comes with an extraordinarily high price tag and the organization that chooses this path should not be one that is adverse to risk and change. The DOD was looking to play "catch-up" with industry. Furthermore, the DOD is a case study in risk avoidance and adversity to change [4]. Ultimately, these factors led to the judgment that

the second option of contracting for ERP software is the preferred course of action and the separate service components (Army, Navy, Air Force and Marine Corps) along with Defense Logistics Agency (DLA) went their separate ways on that path.

Today the DOD is at a midway point on the course toward ERP releases throughout the department to include DLA. All of the enterprise systems are at different points in the development phase and the DOD as a whole is awaiting the results to see if the ERP endeavors will improve or possibly resolve the problems of the current processes and systems that continue to plague the organization to date.

During current operations in Afghanistan and Iraq in support of the Global War on Terror, the forces in battle encounter the same difficulty with logistics that their predecessors in the first Gulf War faced. Those in need go without while unidentified supplies continue to get stockpiled. Logisticians are in an operating environment where they support a unified force but they pull equipment from five different sources of supply. All sources lack the visibility that is vital for encouraging confidence in the system. This lack of confidence leads to continuous re-orders which leads to more stockpiling and waste. The inefficiencies of the defense logistics systems remain the same because the systems are still in need of a common architecture and common processes [5]. Accordingly, the financial accountability these systems produce has not changed and the DOD remains noncompliant with the FFMIA. It is the hope of the services and DLA that their separate ERPs individually and collectively will resolve the existing crisis.

C. STATEMENT OF REQUIREMENT

Billions of dollars have been and will continue to be invested in the DOD ERP programs [1]. At a time when the U.S. is actively engaged in costly combat operations in the Middle East and is in desperate need of updating its aging equipment, the military can not afford to have these programs fall short of their stated objectives. More importantly, the future logistical capabilities and legislative compliance of the DOD will be determined by the success or failure of these initiatives. Thus, it is important that the plans that are being executed for the implementation and integration of these ERPs are

analyzed thoroughly. This research is a comparative study of the different service's ERP strategies to reveal the similarities and differences of the individual plans.

1. Research Questions

To conduct this research, the following questions will be explored:

- What is an ERP?
- By industry's standards, what is the optimal way to implement an ERP?
- How does an ERP integrate business processes that are not part of the standardized software suite?
- What are the experiences and plans of the individual DOD ERP programs?
- What are the lessons learned to date that will assist the DOD in achieving the joint vision for the ERP programs?

D. BENEFITS OF THE STUDY

This research is ongoing while the DOD is still in the early stages of implementation as a whole. The purpose of the research is to gain an understanding of the decisions that are being made throughout the force to enhance the cooperation among the services. To be truly enterprise wide, each of these ERPs are going to have to be integrated with one another at some point in the future [5]. If this integration is never achieved, then the DOD will have five more non-integrated legacy systems that do not contribute to the joint warfighting capability of the force. Thus, it is the goal of this study to aid this future integration by revealing the differences between the programs and the obstacles to implementation that have to be overcome to make these systems successful. Benchmarking the programs against each other and against industry best practices will provide the military leadership a reference for making the decisions that will improve the likelihood for success.

E. SCOPE OF THESIS

The scope of this investigation is to assess how the ERP programs might be able to improve the joint capability of the services and where they might fall short. To do this, it will focus on bringing together the different works that have been completed on the DOD ERPs. It will examine the ERP programs of the Defense Logistics Agency (DLA),

the US Army, Navy, Air Force, and Marine Corps to discover what the programs are doing communally and what they are doing individually.

F. METHODOLOGY

The thesis will use a literature review and interview methodology to gather information about ERP implementations in the private and public sectors. Literature to better understand ERP applications in general will be examined to define what an ERP is and the potential they have to reduce cost and increase capabilities. For the DOD ERP programs specifically, a combination of literature reviews and interviews will be conducted.

G. ORGANIZATION OF THE THESIS

Chapter II will present the history of ERP. It will also cover the potential benefits and hazards of an ERP implementation as well as the steps that should be taken to migrate from the legacy environment.

Chapter III provides an overview of the separate DOD ERP programs. A synopsis of how each of the programs came about will be given. Additionally, the current state and cost of the programs will be explored.

Chapter IV analyzes the similarities and differences between the differing approaches of the separate services and DLA. The results of the study will be drawn form this analysis.

Chapter V concludes the thesis by identifying the barriers that must be overcome to make these programs a success. Several recommendations as to how these barriers might be overcome will be presented. Lastly, some additional areas of research will be opened up.

II. ENTERPRISE RESOURCE PLANNING

A. HISTORY OF ERP

Proprietary systems that are developed by an organization's in-house or contracted software developers are generally referred to as legacy systems. These systems are designed using the overarching principal that whatever business processes are done without the use of a computer can be replicated in software. Automating processes that were formerly done manually provides a benefit in that it decreases the amount of time it takes to complete the same process. Written in high-level programming languages such as FORTRAN and COBOL, legacy systems are the first stage in the evolutionary history of computers in the workplace [6].

The problem with legacy systems is that they are developed to meet particular functions. This design philosophy causes fragmentation between the disparate functional areas. Systems that support a particular functional area but do not integrate with other systems are commonly referred to as "stovepipes" [7]. Since stovepiped systems are often in need of the same data, the result is the data is maintained in several different locations to service the separate systems. Fragmentation and a lack of integration between the disparate systems often result in problems with the consistency of the data residing in the different locals. Data may be updated in one system but the change does not take effect and is not visible in the other systems that are also maintaining that data. The coordination and communication problem that is the consequence of this framework is severely detrimental to the organizations that operate in this way because users have to take extra time to validate data in order to guarantee the reliability of the information being produced from the data [8].

ERP grew out of the foundation laid by legacy systems as an answer to the problems of non-integrated systems. In the 1970s software engineers began to realize that data transcends functional area [8]. Additionally, they began to capitalize on the commonalities that existed between the business processes of different manufacturing companies independent of the end products that were being produced by those

companies. They did this by creating packaged software that was designed to be used in any manufacturing environment with little modification.

1. Materials Requirements Planning

The predecessor of ERP is known as Material Requirements Planning (MRP). It is a software package developed in the 1970s as a simulation tool to answer the questions in the universal manufacturing equation. Manufacturing firms operate under the principals of the universal manufacturing equation which asks [8]:

- What are we going to make?
- What does it take to make it?
- What do we have?
- What do we have to get?

For the companies who elected to purchase an MRP, the logic built into the software uses models of available capacity in the manufacturing plant and linear scheduling to produce a master schedule which satisfies the "what are we going to make" question. To handle the "what does it take to make it" question, MRP uses a bill of materials which details all the components that go into whatever is being made. Calculations of lead-times to receive those components are in the software for the scheduling of purchase orders that must be made to get the components in time for production. This takes care of the "what do we have to get" question and the "what do we have" question is resolved with an inventory database in the MRP [9].

2. Closed-Loop MRP

After their release, MRPs were quickly altered to closed-loop MRPs with the added capability of inputting changes in delivery schedules from the suppliers of sub-components. With the updated delivery schedules, a closed-loop MRP is capable of comparing the new delivery date and the date that the components are required to enter production. The comparison highlights the situations where the components are not going to arrive as scheduled [10]. Feeding back delivery schedules into the MRP is the reason for the loop portion of the new name. The feedback loops which allow the input of updates to reflect the reality of the changing supply environment are used by the

capacity planning tool that was also upgraded in closed-loop MRPs. Plant scheduling functionality was improved so that priorities in production can be modified based upon the information that is coming in on the feedback loops. The feedback functionality characteristics of closed-loop MRPs are diagramed below.

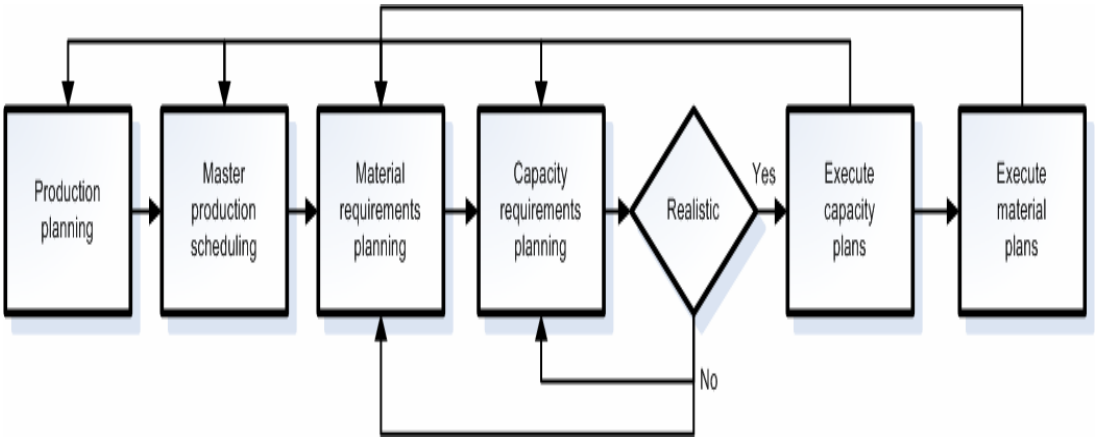

Figure 2.1. Closed-Loop MRP System Showing Feedback (From: [11])

3. MRP II

In 1975, MRPs got more improvements and another new name. The name changed to Manufacturing Resource Planning with an abbreviated name of MRP II. Manufacturing replaced materials as the first word in the new name because the advancements with MRP II allow the user to plan all aspects of manufacturing including personnel, machines and inventory. The two additional components that provide MRP this capability are tools that capture all the cost and sales information of the plant and simulation tools that allow the user to change different aspects of the production plan to perform "what-if" analysis that can then be acted upon [12].

4. ERP

During the technology boom of the 1990s, MRP II was expanded beyond manufacturing floor by incorporating customer relations modules, human resources information, facilities management, and accounting into the common database repository of the software. Today's ERP is an enterprise wide system that integrates all aspects of what an organization does and delivers current cross-functional information to every department and supply chain member in the organization.

Figure 2.2. The ERP Wheel (From: [4])

5. ERP II

The current movement in the world of information technology (IT) is to branch out of the enterprise and link the organizational systems to the companies that business is conducted with. Using the internet or electronic data interchange (EDI), organizations are sharing the data in their central ERP repositories with the trusted companies in the supply chain. Not only are companies sharing data, they are also sharing business processes and shattering the barriers to information that traditionally existed between interacting organizations. This contemporary free-flow of information between organizations that are fusing separate enterprise systems is called ERP II [13].

Companies that interact in this manner are operating under what is known as the "web-like" value chain concept [4]. The hallmark of the concept is that the systems of the separate organizations are integrated so that the information held by the systems is visible to the employees, customers, suppliers, and trading partners who are held responsible for acting on this information. Not only are the systems integrated, but the business processes between the organizations are automated. This automation eliminates the phones, faxes, and e-mails that have been traditionally used to conduct transactions

and chase down the most current information. Instead, all parties involved have total access to the updated information about the dynamic events and transactions that are occurring within and between the separate organizations. In industry, companies that operate in the "web-like" value chain are referred to as real time enterprises because they are acting on the most-current information available from their integrated business systems [14].

B. EXPECTED BENEFITS OF AN ERP

When an organization successfully implements an ERP, the benefits it can expect include [15]:

1. **Cycle time reduction** ERP can provide substantial benefits in terms of cost and time reduction in key business processes.
2. **Faster information transactions** An ERP can deliver a reduction in the time to enter pricing information from five days to five minutes.
3. **Better financial management** One of the basic functions of ERP systems is managing financial information across the enterprise.
4. **Laying the groundwork for e-Commerce** Centralized data in an ERP system facilitates linkage to e-Commerce systems.
5. **Making tacit process knowledge explicit** Key processes, decision rules, and information structures are well understood and documented in an ERP system.

These benefits are compounded when an organization becomes a real time enterprise and transparency is achieved across all the companies in the supply chain. A quality ERP implementation allows every department to know exactly what every other department is doing. Adopting ERP II and opening ERPs to the other organizations in the supply chain permits every department throughout the separate organizations to know what resources are available for use at all times. When a company takes this action it is extending the enterprise and the information that is produced results in profitable decision making [16].

1. Shortened Timeline

The expected benefit of having an integrated database that facilitates the transparent flow of information throughout an enterprise and between interacting enterprises is the primary reason for choosing an ERP system. It is this capability that

brings about improved business processes and increased profitability. Yet, there is an additional reason for electing ERP in that it shortens the timeline associated with software development.

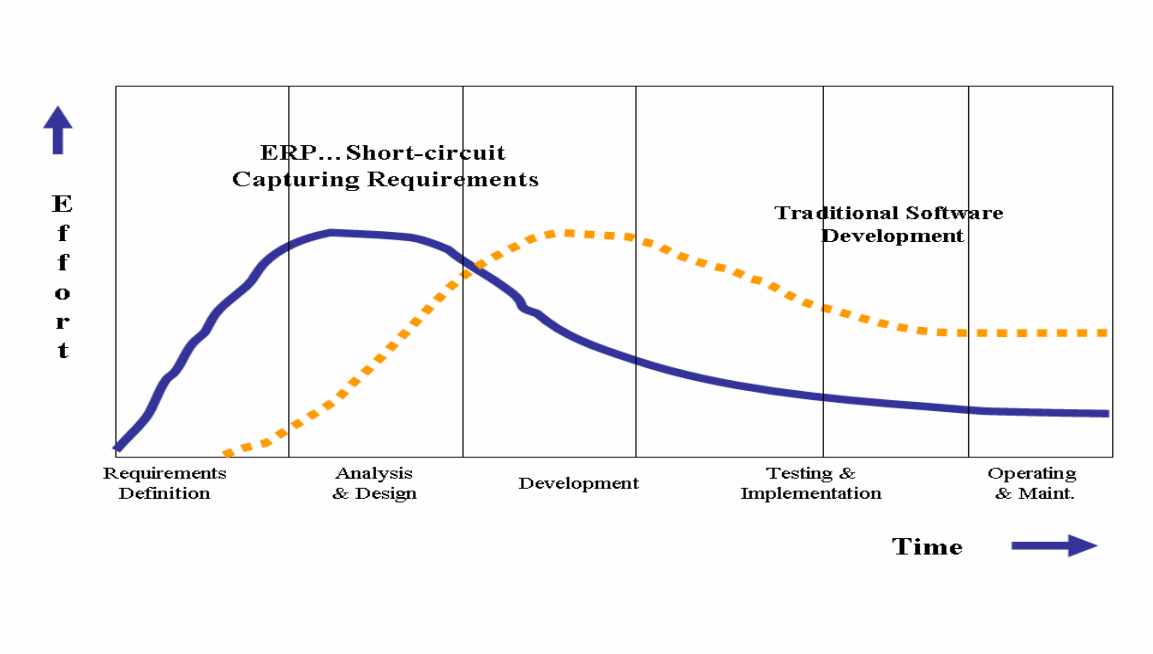

Figure 2.3. ERP Implementation (From: [4])

An ERP is software and because it is, all of the phases of software development from requirements definition to operations and maintenance must be gone through to get the system up and running. The time it takes go through the phases is abbreviated due to the fact that the ERP for each individual organization is developed using a generic template that models the way work should be performed in that particular industry. For example, if the company performing the implementation is a manufacturing company, the manufacturing template will be used. If it is a distribution company, then that template will be the starting point. In addition to the templates for the commercial sector there are also ERP templates for educational and government institutions. Since the requirements of the industry or organization are known and built into the template, the time it takes to do analysis and design along with system development can be dramatically shortened [17].

C. VENDORS

Today's ERP market is divided into two levels of suppliers: large-scale and small-scale. Capturing approximately 64 percent of the total ERP market revenue are the three large-scale suppliers SAP, Oracle Corporation, and Baan International [4]. The remaining 36 percent of the market is spread among the smaller ERP companies that produce specialized ERPs for particular industries.

Five former IBM employees founded SAP and created the first ERP. As the originator of ERP technology, SAP holds the top position among ERP providers and controls 30% of the market. Behind SAP is the Oracle Corporation with 24% of the market. Oracle has established a high market share because of its advantages in scalability and better coordination with suppliers and customers [18]. It also increased its market share after performing a hostile takeover of the PeopleSoft Inc. in January of 2005 [19]. The takeover provided Oracle with the 9% of the ERP market that was previously held by PeopleSoft. Companies that concentrate on global operations tend to choose BAAN International because of its modules that link the monetary and technological requirements of the various countries operated in [18].

D. SUCCESS STORIES

Several of the best run and most successful companies in the world run ERP software and those companies that are looking to continue those successes are making the transition to being ERP II organizations. It has been reported that over sixty percent of U.S. Fortune 1000 companies run an ERP [20]. Many of these companies made the transition to an ERP prior to the year 2000 to achieve Y2K compliance. Within the companies that elected ERP for Y2K compliance, the decision was made to buy the latest packaged software on the market vice trying to fix the Y2K problems residing in their old computer systems. It is a good thing that the companies did make the transition because by integrating the data throughout the organization, these companies have been able to speed up processes, improve communication, and make better decisions. The result is a position amongst the U.S. Fortune 1000 companies and more satisfied customers yielding bigger profit margins.

1. General Electric

An example of an industrial giant that moved to an ERP in the 1990s is General Electric (GE). With roughly 300,000 employees worldwide GE is an industrial behemoth that does everything from making jet engines to managing financial portfolios. GE implemented an Oracle ERP and received all of the expected benefits from the implementation including cycle time reductions, faster information transactions, better financial management, and e-Commerce expansion. Furthermore, when most companies were drastically reducing their investments in IT after the bursting of the "dot-com bubble" in 2001, GE increased IT spending by twelve percent in 2002. The increase was caused by the Chief Executive Officer, Jeff Immelt's belief that GE needed to move beyond ERP to ERP II. The company desires to digitize every business process that could be digitized internal and external to the company. It is an initiative that has paid off and continues to pay off. Aided by the ERP II initiative, between 2002 and 2006, the company's consolidated revenue grew from $112 to $163 billion [21] and in 2006, GE ranked first overall in Fortune Magazine's "America's Most Admired Companies" [22].

2. The United States Mint and Strategic Petroleum Reserve

ERP has been proven to work as well in public organizations as it does in private entities. In 1998, a bureau of the Department of Treasury, the U.S. Mint implemented an SAP ERP system to replace the multiple legacy systems it was running. The Mint is a unique public sector organization because it is self-funded and profit-driven. It generates profit by selling coins to collectors. Prior to 1998, the legacy systems run in the Mint were incapable of properly handling the planning, tracking, inventory and scheduling of the raw materials that go into producing coins. Packaging and delivery of the coins following production was also inadequate with only half of customer's orders being shipped within eight weeks of purchase [23]. The accuracy and timeliness of financial and management information was an issue as well. Problems with the mint's information systems did not end inside the organization. There was no interface to connect the 1.1 million coin collecting customers to the mint's IT systems. The only way customers could purchase coins was through a mail order catalog or at three retail kiosks [23]. It resulted in profits that were well below what they could have been. To fix the problems

with the internal processing systems, the ERP was the first thing to be implemented. After the ERP was up and running, an on-line retail site was established in 1999 to interface to the customers. Both endeavors were a resounding success. In total, the projects cost $40 million with a projected seven-year savings of $80 million. Additionally, in 1999 revenue increased by 51.9% over 1998 as a result of the popularity of the e-commerce site [2].

In the same timeframe that the U.S. Mint was migrating from the legacy environment to an ERP, another Federal agency, the Strategic Petroleum Reserve (SPR) was also making the switch. Established following the OPEC oil embargo of the 1970s, the purpose of the SPR is to store and maintain an inventory of crude oil as a deterrent to oil import cutoffs. The SPR also provides an emergency stock of oil in the event that it is needed for national defense [24].

SAP was selected as the vendor to provide an ERP solution to the SPR in 1997. It was determined that the SPR needed to change their information systems because it was experiencing the traditional problems that occur with legacy systems. The same data existed in numerous locations and the confusion that resulted was hampering mission performance. The SAP ERP was up and running in March of 1999 and the eight legacy systems of the SPR were turned off. Like the results at the Mint, the SPR's ERP was a triumph and achieved 98% of the organizational goals that were established at the outset of the project [25]. A year after going live on their ERP, the SPR advertised a 47% return on the $10 million ERP investment [2].

E. CRITICISMS OF ERP

Along with the proponents and success stories supporting ERP systems, there are also many critics and ERP failures. Criticism is not misplaced since the statistics covering IT project failure rates are not encouraging. In 1997, the consulting firm KPMG questioned Canada's leading 1,450 public and private sector organizations. The intent of the questionnaire published was to figure out the reasons behind the failure of IT projects. Over 61% of the projects analyzed in the study were reported as failures [26].

1. The Boston Consulting Group and Robbins-Gioia Surveys

More recently, two other surveys were conducted specifically addressing ERPs. The first of these was completed by the Boston Consulting Group in the year 2000. After surveying 100 executives of leading companies about their ERP initiatives, they found that only one out of every three executives considered the initiative a success [27]. These results were supported by the survey of another consulting firm in 2001. Robbins-Gioia LLC conducted the same type of questionnaire survey about the perception of organizations with regard to their ERP package implementations. A total of 232 organizations responded and 36% of the respondents had, or were in the process of implementing an ERP. Of the enterprises that had experience with an ERP system [26]:

- 51% viewed their ERP implementation as unsuccessful.
- 46% of the participants noted that while their organization had an ERP system in place, or was implementing a system, they did not feel their organization understood how to use the system to improve the way they conduct business.
- 56% of survey respondents noted their organization has a program management office (PMO) in place, and of these respondents, only 36% felt their ERP implementation was unsuccessful.

There is a bias in both of these surveys because they are based upon perceptions of the ERPs and they do not take into account if the ERPs cited as unsuccessful achieved the goals established. Additionally, if the survey respondents were not part of the implementation team and the systems were forced upon them, they are inherently going to have a pessimistic view of the ERP [26]. Despite these facts, the surveys are a good demonstration of the fact that the odds of success are not stacked in favor of the ERP. Thus, ERP project managers must be aware of, and attempt to avoid the pitfalls associated with ERP failures.

2. Pitfalls of ERP Implementations

With the multitudes of ERP implementations (both successful and unsuccessful) occurring over the last two decades, there has been plenty of opportunity to discover and define the ERP pitfalls that should be avoided. Prior to going into what those pitfalls are, it is important to delineate what constitutes a partial and total ERP failure. Different criteria for partial failure include [After: 28]:

1. Not making the promised return on investment,
2. Inordinately extending the implementation schedule and start-up date,
3. Running over budget by large variances,
4. Grinding the organization to a crawl pace, or the severest of all consequences,
5. Stopping production and/or not delivering orders to your customers.

What can be considered a total failure is to invest large sums of money into an ERP only to find that the organization is incapable of seeing the project through to completion. Thus, the ERP project is terminated and the organization finds itself back at the starting point with nothing to show for the resources expended. Such a tragedy is an indication that there was not enough research into what would be required of the organization in the transition to the ERP environment [8].

In order to prevent having a partial failure or a total failure, an organization that is planning to adopt an ERP should be made aware of, and expend every effort and all resources required to evade the pitfalls and consequences summarized in Table 1.

Pitfall	Definition	Consequence
(1.) Overcustomization	Every organization is unique in data requirements and business processes. Customizations transform packaged ERP software into ERP software that meets organizations' individual business processes and operations.	Long and expensive customization efforts often result in the pass of release deadlines and budget overruns. Customizations may make the software more fragile and harder to maintain when it finally goes to production.
(2.) Lack of Top Management Commitment	The delegation of the ERP project to lower management levels.	Upper management is "out of touch" with critical events and the scope of the project. This results in a lack of resources being committed to the project.
(3.) Resistance to Change/Lack of Buy-in	Lack of a change management program.	A lack of buy-in often results from not getting end-users involved in the project from the very start, thereby negating their authorship and ownership of the new system and processes.
(4.) Inadequate Requirements Definition	Not comprehensively and systematically developing a quality set of functional requirements definitions.	Poor package selection resulting in implementation failure.
(5.) Poor ERP Package Selection	Inadequate research into whether or not the proposed system will meet the users needs.	Implementation failure.
(6.) Inadequate Resources	Attempting to save money by having the organization's employees implement the ERP on an overtime basis.	The organization's employees do not have the skills required to implement the software and they burn out.
(7.) Miscalculation of Time and Effort	The miscalculation of effort and time it will take to accomplish the project.	ERP project is doomed to failure.
(8.) Misfit of Application Software with Business Processes	Not examining the business processes in the software that is going to conflict with the business processes of the organization.	A failure to integrate the applications with the business processes causes loss of productivity and time, and ultimate benefits.
(9.) Unrealistic Expectation of Benefits and ROI	Software providers are notorious for overstating the benefits in terms of ROI, when the total costs of the project have been understated.	No chance of achieving the anticipated ROI.

Pitfall	Definition	Consequence
(10.) Inadequate Training and Education	ERP-related training is crucial as most employees must learn new software interfaces and business processes which affect the operation of the entire enterprise.	Shortchanging this part of the ERP implementation leads to much pain and suffering downstream.
(11.) Poor Project Design and Management	Short-cutting critical events in the project plan, such as time for documentation, redefining and integrating processes, or testing before "going live."	Weaknesses and opportunities for improvement are not identified.
(12.) Poor Communications	A failure to announce the reason for the up and coming effort, and not continuing to advise the organization of the progress and importance of the ERP implementation to the company.	Different parts of the organization will not able to assess how they will be impacted by changes in processes, policies, and procedures.
(13.) Ill-advised Cost Cutting	Going live at multi-plant sites simultaneously or, unrealistically compressing the schedule in order to save on expenses.	Subjecting all plants or some plants to a total shutdown should there be a false start-up. An overrun of both the schedule and the budget.

Table 1. ERP Pitfalls and Consequences (After: [28, 29]).

One of the most commonly cited partial failures in history occurred as a result of a company's inability to dodge a pitfall.

3. Failure at Hershey Foods

In 1998, the leading manufacturer of chocolates in the United States, Hershey Foods attempted to implement an SAP ERP with consequences that cost the company tens of millions of dollars. The problem at Hershey involved pitfall number seven: miscalculation of time and effort. Believing that the company could push into the final stages of implementation during a peak period for business (right before Halloween), the company attempted to do both. The truth was that the ERP implementation brought about major changes to Hershey's business processes at a time when the company needed to be focusing on its core competency of producing and distributing products. Unfortunately, something had to give and in this instance it was the production and distribution of products. The result was that for Halloween 1999, the problems with the

ERP prevented the delivery of $100 million in candy and Hershey's stock price fell more than 8% in a single day [30]. In the long run, what happened to Hershey was only a partial failure. The company recovered from the loss and continues to produce sugary treats. Some Wall Street financial analyst even argue that the company does it better now with their new system.

4. The Nestle, Allied Waste and K-Mart Experiences

Similar to what happened at Hershey, another major chocolate producer, Nestle also had significant difficulties with their ERP implementation. After starting an SAP ERP implementation in 1997, by 2000 the company was facing a complete collapse. To blame for the predicament was pitfall numbers three: resistance to change/lack of buy-in. The ERP project team had failed to include the key stakeholders who would be most affected by the new business processes and systems. Thus, when the ERP was rolled out for use in 2000, the company experienced a major personnel problem. The workers who were supposed to use the system had no idea how. Their ignorance was compounded by the fact that their superiors could not be of any assistance because they were left out of the project as well. Fearing the worst, the company stepped back from the $200 million project midway through and took it in a new direction. The new direction was to deemphasize the release of software and emphasize management of the change that the workers were going to experience with the ERP. Key stakeholders were brought into the project team and training on the new system became widespread. Fortunately, the ERP team at Nestle had the wisdom to shift the emphasis because by 2002, the company was touting a $325 million savings from their ERP. Hindsight being what it is, at the conclusion of the ERP, Nestle's team leader stated that "The primary lesson taken away from the project is this: No major software implementation is really about the software. It's about change management" [31].

Allied Waste Industries and the retailer K-Mart were not as fortunate with their ERPs as Hershey and Nestle. After spending over $40 million on an SAP ERP, Allied Waste declared the system too complex, too expensive and a poor fit for the way the company does business. It was ruled a total failure and the company wrote-off the $40 million as a loss [32]. K-Mart also experienced a total failure with their ERP and had to

write-off a $130 million loss. Total failures such as these are not as common as partial failures, but, they are included as evidence of the worst that can happen if the pitfalls of ERP are not thoroughly analyzed and prepared for prior to starting the project.

F. ERP PAINS

As organizations world-wide move away from systems developed "in-house" toward the packaged software of ERPs, studies have shown that what happened at Hershey and Nestle is the norm vice the exception [30]. The cost and publicity of the partial failures are usually not as dramatic as those suffered by Hershey, but they are almost always present in an ERP undertaking. Commonly, installation of the software is late and business processes suffer for approximately six months [30]. These problems that have become the standard with ERP implementation account for the negative perceptions that were revealed in The Boston Consulting Group and The Robbins-Gioia surveys. Of course, there are exceptions to this standard because some organizations can never overcome the pitfalls (Allied Waste and K-Mart) and some are extraordinarily successful at managing the pitfalls and never experience the pains normally associated with ERP. For example, the Microsoft Corporation went live with an SAP ERP within seven months of the initial planning meetings and immediately captured the benefits of the integrated ERP environment [5]. Microsoft is the worldwide leader in computing software so familiarity with software driven initiatives certainly came into play. Nonetheless, Microsoft credited the success with their ability to control pitfall number two: lack of top management commitment. Ultimate responsibility for Microsoft's ERP implementation rested with the Chief Operating Officer [5]. A top official was charged with monitoring the implementation schedule and his visibility in this role emphasized the importance of the ERP project to everyone in the corporation.

Instantaneous success with ERP like what was experienced at Microsoft is the exception. The foundation of ERPs is that business processes transcend an organization's functional areas. It follows that the design of ERPs is standardized with the best business practices and processes built-in to the software. Historically, legacy systems are built around the activities of different functional areas. The system used depends upon the department that the worker is operating in. If something goes wrong outside of that

particular department, it is somebody else's problem. ERP destroys this mentality because the people in the different departments can see all of the same information. Thus, the accountability that is required of all the departments is tested in an ERP like never before. If a department is not operating as it should be, it is going to immediately be visible to all the other departments in the organization. To obtain such visibility and business process integration, the organization that adopts an ERP must conform to the processes that are resident within the system. This entails an extensive business process reengineering effort due to the fact that all new business processes will be put in place. Attempting to do it any other way would mean trying to conform the ERP to fit the old way of doing business which is leads to pitfall number one: overcustomization.

1. The Role of Change Management

Business process reengineering (BPR) of the magnitude required by the installation of an ERP mandates that the organization undergo what is often referred to as a technochange. The term techno comes before change because it is a change that deliberately uses IT to transform an organization. A technochange is different than an IT project because in an IT project, the only department involved in the project is the information services (IS) department. The extent of an IT project does not go far beyond upgrading the current systems or IT infrastructure to achieve better response times and performance. A good example of an IT project is the upgrading of servers. While such a change would have a big impact on the IS department, it would generally be transparent to the system users except for the improved performance the users experience as a result of the upgrade.

Technochange uses IT to alter the organization's behavior and has an impact far beyond the IS department. In a technochange initiative, the organization has elected to use technology that mandates a change in business processes. Consequently, the people who use the new IT system and the organization as a whole must undergo a radical transformation. This type of transformational change using IT requires more than just good software developers and programmers who can produce a smooth running product. In order to achieve the performance improvements that technochange products (like ERPs) advertise, the users of the product must be prepared for a significant divergence

from their current processes. It is this requirement that causes the word change to encompass the second half of the phrase technochange [33].

Change is a broad expression that has several orders of magnitude. There are big changes, small changes, changes that take several years and changes that are completed in only seconds or nanoseconds. Beyond orders of magnitude, a second characteristic of change is that it affects virtually everything. Organizations do not have the capacity to escape the grasp of change and accordingly they fall victim to it. The most extreme change an organization can go through is known as a transformational change. Transformational change requires a drastic reconceptualization of the way work should be done by the workers undergoing the transformation [34]. It is the hardest type of change because it requires the organization to disregard the past and work toward the leadership's vision of what the organization should look like. Due to the scope of change that is brought about by technochange initiatives such as an ERP, it can only be classified as a transformational change. Most transformational change efforts fail because of the amount of effort they require at all levels of the organization. Technochange endeavors are no exception to this rule [33]. This is the reason that the statistics involving worker's perception of ERP initiatives are dramatically pessimistic. Reactions to changes in organizational business processes are negative because the changes to the way people work in an ERP are drastic. Even when the ERP does what it was designed to do and does it well, the pain of the change that is experienced by the organization will have an inverse relationship to the cost of the program. However, the relationship is not directly inverse; the most pain resulting from the organizational change comes after the majority of the spending on the project has taken place. Thus, the real barrier to seeing the project through to the point where the net benefits begin to get realized is not a matter of economics but a matter of how well the organization can manage the change that is taking place.

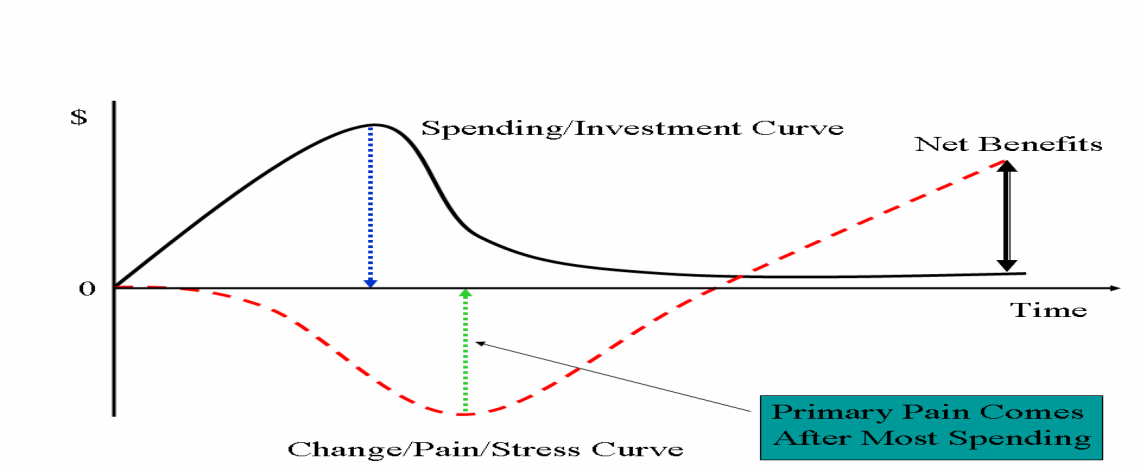

Figure 2.4. BPR: In it for the Long Run? (From: [35])

To help the organization through the pain caused by the change takes a mastery of pitfalls two (Lack of Top Management Commitment) and three (Resistance to Change/Lack of Buy-in). Managing pitfall two is self explanatory: to successfully transition to an ERP, the change can not be driven by middle managers. The leadership at the highest level of the organization must be convinced that a change is necessary and commit to pushing their agenda for change. Once the ERP technochange has been firmly established as the leader's agenda, that leader must begin to foster support/buy-in for the ERP. A technique for developing a consortium of supporters for the change is to surface a mini crisis which dictates that a change must occur. The BPR life cycle provides a clear demonstration of the phases of a technochange initiative with regards to the organizational resistance that must be met and overcome.

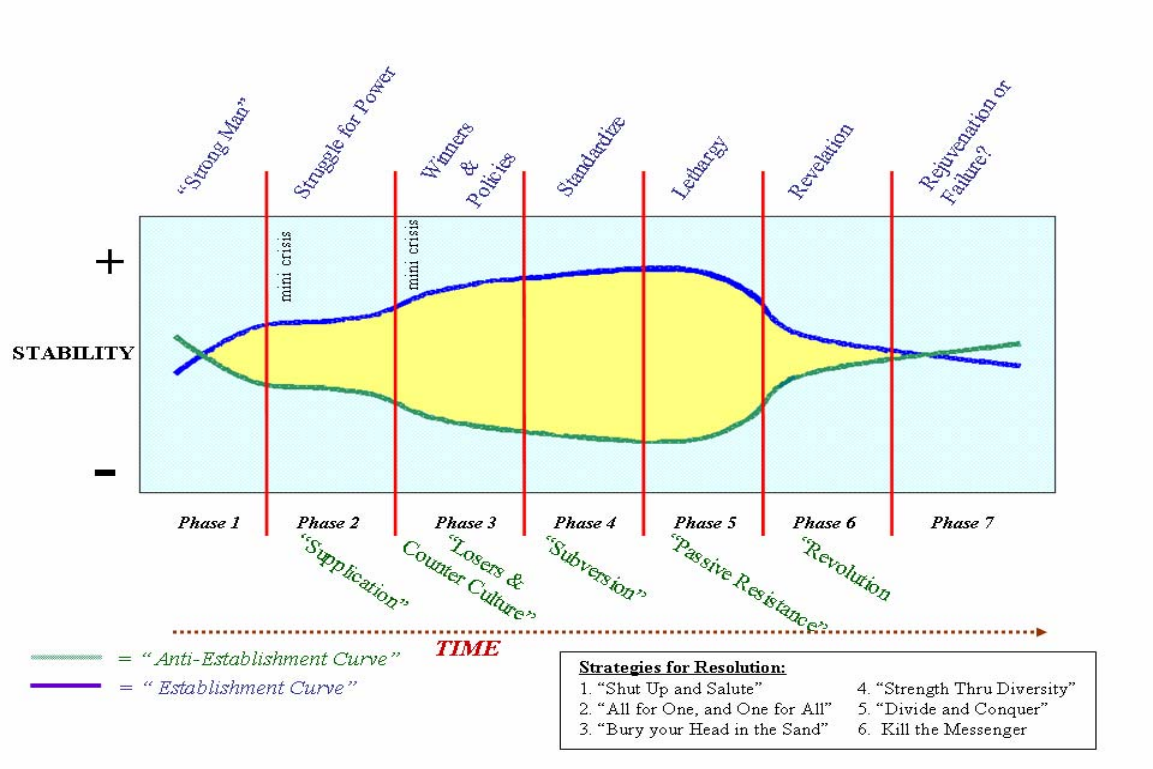

Figure 2.5. BPR Organizational Life Cycle (From: [36])

In the beginning of the change, a "strong man" must emerge and create a crisis that demands change. For example, at Microsoft, the "strong man" of the ERP initiative was the Chief Operating Officer. The crisis that he used to gain support for the decision to transition to an ERP was the incredible growth that the company was experiencing in 2001. A growth that was so impressive that it was straining the financial, operations, and human resources systems of the company. ERP was chosen as the solution to the problem and it was rapidly implemented [5].

In this case, Microsoft chose an authoritarian approach to contend with the BPR organizational life cycle. A top leader was selected, a solution was chosen, and the technochange was pushed through with little time for opposition. This is one way of countering the resistance to change in the "struggle for power" phase of the life cycle. Another way of countering resistance is to create buy-in. An approach that has been developed and has had proven success at creating buy-in is known as prototyping. This approach involves the development of a futuristic model of how the system will work and the capabilities that it will bring to bear as a demonstration to the users to get feedback on

how the prototype can be refined. The fact that the users also get to work with the system and experience its functionality firsthand goes a long way toward instilling a sense of ownership at the user level in the change effort. This "grassroots" support can be a critical ingredient towards a project's success. Prototyping does not negate the need for a "strong man" but it can be used by the "strong man" as a tool vice having to resort to a dictatorship [33].

A variation of the prototyping approach is a pilot project. Pilots entail testing an organizational redesign in one or two locations. If the redesign proves its value in those locations then it can be employed throughout the rest of the organization. Pilot projects reduce risk by proposing easy termination if it is determined that the project is not going to meet expectations [33].

The approach that an organization applies to steer an ERP implementation through the BPR organizational life cycle is not as important as the life cycle itself. An organization can use prototyping, pilot projects, or an authoritarian approach and they can all be equally effective. The important thing is that when it comes to an ERP initiative, the life cycle is very real. People do not like change and the organizational change that is required by an ERP is going to generate resistance. If the organization does not follow the life cycle and counter the resistance with a "strong man", incremental victories and continual improvements, the resistance movement will prevent success.

2. Cost

Prior to phase one of the BPR life cycle and the "strong man's" announcement that an ERP project is going to take place, resistance to the project will appear because of the cost. With an average total cost of ownership (TCO) for a large ERP in the hundreds of millions, making the decision to acquire these systems will significantly affect the organization's bottom line [32]. The TCO includes the cost of the hardware, software, professional services and staff, but, along with the TCO, there are also hidden costs that potential consumers should be aware of. Many of these hidden costs occur because of a failure to manage the ERP pitfalls. Professionals in the ERP industry cite these hidden costs as the source of budget overruns. These costs result from [After: 17]:

1. Training – Developing a curriculum to train all the people in the organization impacted by the ERP was voted the number one underestimated budget item.
2. Integration and testing – Integrating the ERP with the other software systems the organization is using and then testing those links can be costly.
3. Customization – Losing control of pitfall number one and transforming the ERP into custom software will definitely overrun the budget.
4. Data conversion – Moving the data from the legacy systems to the ERP comes with a high price tag.
5. Data analysis – If the data needs in the ERP needs to be combined for analysis and data mining, the cost of the tools to do this should be projected.
6. Consultants ad infinitum – Be wary of continually increasing the number of consultants to manage the project. The objectives and cost of the consultants must be clearly delineated early-on.
7. Replacing your best and brightest – Employees with earned skills from the ERP implementation will be in high demand. Funds must be available to keep these people or replace them with IT workers that have similar skills. Replacing them will cost much more than rewarding them appropriately.
8. Implementation teams can never stop – The ERP must be continually improved upon and rejuvenated as demonstrated in the BPR life cycle. Keeping the team together and actively improving the system comes with a cost.
9. Waiting for ROI – The return on an ERP will not be noticeable for a long time after implementation. An organization must be financially prepared to wait.
10. Post-ERP Depression – After the ERP goes live, there is going to be a drop in organizational performance while people get accustomed to working with the new system.

With such a high TCO and the significant risk of budget overrun from the hidden costs, resistance is going to build because there will be those that wonder what the justification could possibly be for embarking upon a project that is almost guaranteed to overrun the budget and has the potential for being a complete disaster. An ERP can not be defended with the argument that it provides a competitive advantage to increase revenue. A competitive advantage is provided only by a capability that one organization has that competitors can not gain access to. For example, Wal-Mart's IT systems can not be classified as legacy because of the huge sums of money that the company spends to

keep their systems on the "cutting edge" in SCM processes and speed. The competitive advantage of the company resides in those systems. If Wal-Mart were to change over to an ERP, they would lose that competitive advantage and they would be on a level playing field with every other discount retailer. ERPs are available to every organization willing to pay the price so they do not offer a competitive advantage. They are a good choice for an organization that does not quite know what it's processes are and is therefore looking for a software package to implement the "best practices" of the ERP. Utilizing the software's processes prevents having to go through an extended systems analysis time trying to figure out what the organization's processes are and then analyzing if those are the processes they should be following [4]. In the ERP's best practices lies the potential for improved internal operations. They do not offer competitive advantage but they do offer the potential to rise to a level of service that has become the standard. If an organization is functioning extremely well without an ERP, then there is no need to buy one. However, if an organization finds that they are unable to track customer orders, coordinate manufacturing with those orders and is carrying an excessive amount of inventory, then an ERP is a good choice [17]. The most successful companies in America are using an ERP. A fact that is supported by the following statistics [4]:

- 7 of 10 Most Profitable
- 9 of 10 with Highest Market Value
- 7 of Top 10 Pharmaceutical Companies
- 7 of Top 10 Computer Companies
- 7 of Top 10 Petroleum Companies
- 6 of Top 10 Electronic Companies
- 8 of Top 10 Chemical Companies
- 8 of Top 10 Food Companies

With these statistics, which delineates who is using an ERP, a company that can not compete with the companies that are successfully running an ERP will quickly fall behind.

3. Alternative to ERP

Thus, the question becomes what is the alternative to an ERP? The only alternative to adopting an ERP is to develop custom software and attempt to build-in better business practices than what is contained in an ERP. There are several problems with this alternative which increases the risk and cost associated with it. A clear fact that has already been established is that people do not like change. Consequently, when the software development life cycle begins with requirements definition, it is hard to define requirements that are a drastic departure from the current business processes. The biggest part of requirements definition is asking the users of the current systems what the requirements of the new systems should be. Unfortunately, the natural tendency of users is to describe the way they currently do their job which leads to the old business processes being established as the requirements of the new system. The second problem with custom software is the amount of time it takes as compared to an ERP implementation. New software does not have the benefit of a template to work from so everything is built from ground zero. This substantially increases the analysis and design phase and the development phase of the life cycle. The longer a project exists in the developmental stages prior to implementation, the longer the resistance movement has time to build against it. A strengthened resistance force can eradicate a software project faster than anything else [37]. Lastly and most importantly, ERPs have been proven to work. Any new software development effort can not make this claim. While the chances of having a completely successful ERP are not great, the risk of a total failure is much higher with a custom software project [38].

4. Customization Risk

Since an ERP is not custom software, an ERP project team has to be wary of those that wish to turn it into custom software thereby destroying the value of the template. After the cost dispute has been countered with a demonstrated necessity, the next source of resistance will be system users that disagree with the way the ERP template matches the traditional business processes of the organization. The disagreement will occur when the template does not include a process or capability that a power user or business baron believes should be in the ERP. If the power organizational

player wins the day and the ERP is changed, then the number one pitfall (customization) is realized and the organization is in trouble. This is the principal source of ERP pain because it makes the system unstable and hard to maintain. It negates the benefit of having a proven template and it is the most commonly cited reason for ERP problems [17].

Every organization is different and a measure of customization is needed by all. The important thing is the customization must be kept to a minimum. Capabilities in the legacy software may not be in the ERP. There is going to be lost capability in every ERP project. On the other hand, to obtain the enterprise wide integration that the ERP is attempting to achieve, a measure of sacrifice is going to be required in the hope that the benefit more than justifies the sacrifice. Thus, a close examination should be made to determine if the capability is a necessity or not. If it is not a necessity it can be discarded in the interest of the organization as a whole. Conversely, if the "strong man" of the ERP project team concludes that it is a necessity, an interface to the capability is a better choice than modifying the core ERP software. To cover the gaps between the necessary processes and capabilities and the embedded processes in the ERP, the acronym RICE is used. RICE stands for reports, interfaces, conversions, enhancements. It is the order that solutions should be sought to cover the gaps. The first possibility to be explored is a report. If the same information that is in the legacy system can be retrieved using a report out of the ERP, then that is the best solution. Secondly, an interface to a system that has the required capability is the next best solution. If that does not work than a conversion of the data in the old system into a form that the logic in the ERP can handle is the third option. Finally, if nothing else can be done, enhancing the core ERP can take place. It is imperative that this option should only be selected as a last resort when there is no possible alternative to achieving the capability [39].

In order to make determinations about the necessity of processes and capabilities, the "strong man" has to be someone at the highest levels of an organization. If it is a person that does not have the required power to make and enforce all the decisions concerning the ERP, then the organizational barons will win and the result will be an extraordinarily expensive piece of custom software that is unstable and can potentially bring the organization to a standstill [17].

G. LIFE CYCLE

Helping organizations avoid the pitfalls navigate through an implementation is the ERP life cycle.

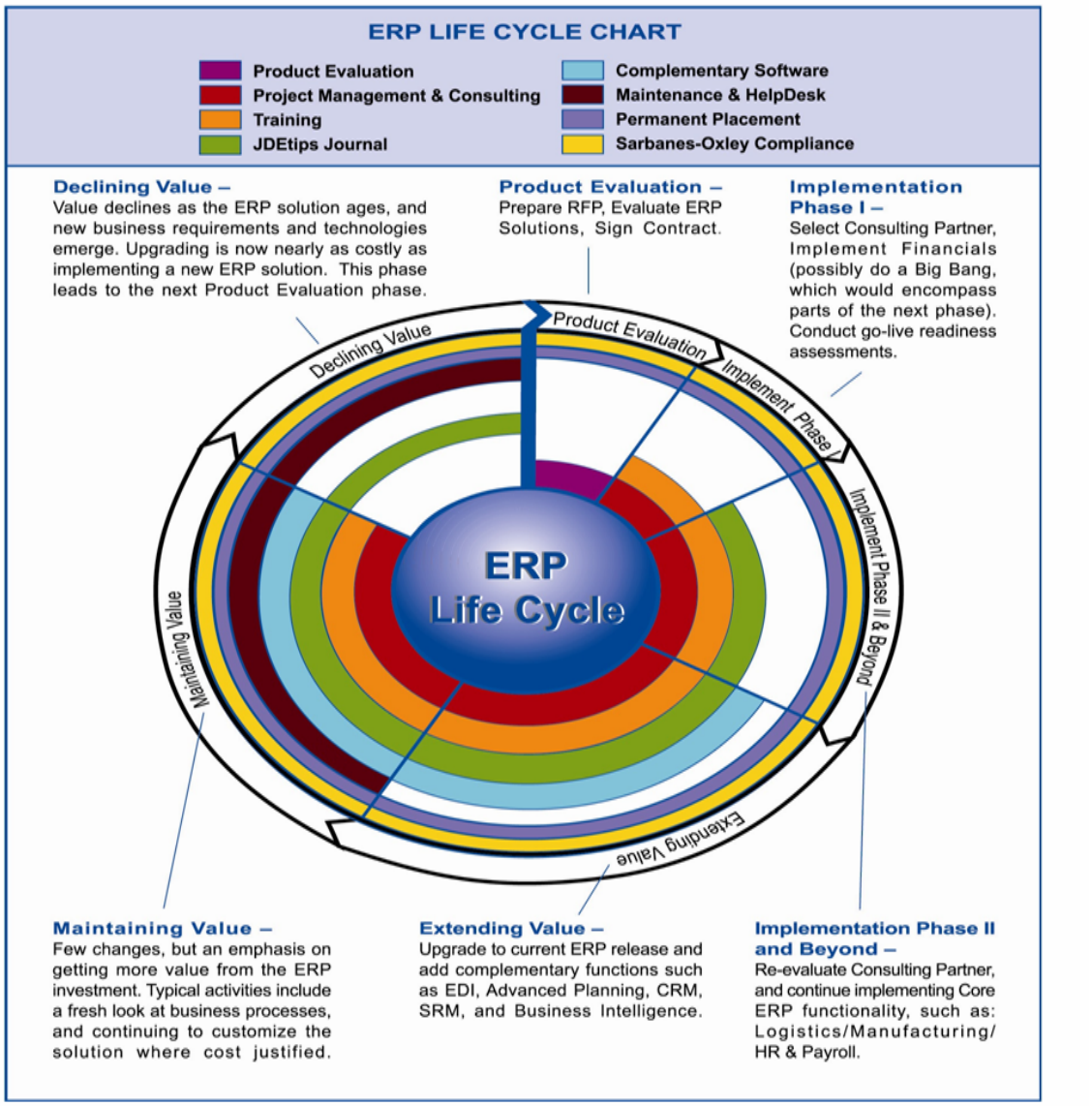

Figure 2.6. ERP Life Cycle (From: [40])

1. Product Evaluation

After making the decision to look at ERP software, the first phase of the life cycle is product evaluation. During the product evaluation stage, the vision for what the organization wants the system to do needs to be established. Before any vendors are brought in to demonstrate the capabilities of their systems, the organization has to ask itself: what are the requirements of the system that we plan to select? What does it absolutely have to do in order for us to conduct business? Where are the areas we are looking to improve? Once these requirements are outlined, a request for proposal should be issued to some prospective vendors asking them how they handle the key requirements. It is beneficial to have the vendors submit screen shots with their proposals for the handling of requirements since a picture is worth a thousand words [40].

The vendors with the top three proposals should be invited for a demonstration day. All of the operational leaders of the organization and head IT personnel who will be involved in the project ought to be present for the demonstration to discuss functionality and technology. The leaders will also want to use the demonstration time to dissect how the corporate culture of the vendor matches that of the buying organization. They can do this with questions like [40]:

- Is this vendor someone you want to do business with?
- Will they be responsive when you've got a dead-in-the-water situation?
- Does the vendor have a culture that wants to do a fantastic job of taking care of their customers?
- Can they give examples of where they have done that before?

With the last question, it is especially important to listen for an answer where the vendor has done a fantastic job for an organization that is functionally similar to the buying activity. The demonstration and the questions that follow will provide enough insight to pick an appropriate ERP system.

2. Implementation Phase I and II

Implementation is generally not done by the vendor. Usually, an integrator is selected to assist the transitioning organization with the implementation. Integrators are consulting firms that are helpful when there is not a large body of "in-house" expertise on

enterprise systems [41]. The leading integrators in the ERP market are the large IT consulting firms such as Accenture, Bearing Point, Computer Sciences Corporations (CSC), Price Waterhouse Coopers, EDS, and IBM [2]. Selecting the right integrators is critical because they are the link between the organization's needs and the ERP chosen. Additionally, the integrator is going to structure the plan for the implementation so their reputation in ERP undertakings at a scale that is equivalent to the one being asked for is extremely important [41].

The integrator will guide an organization along what is known as the proven path.

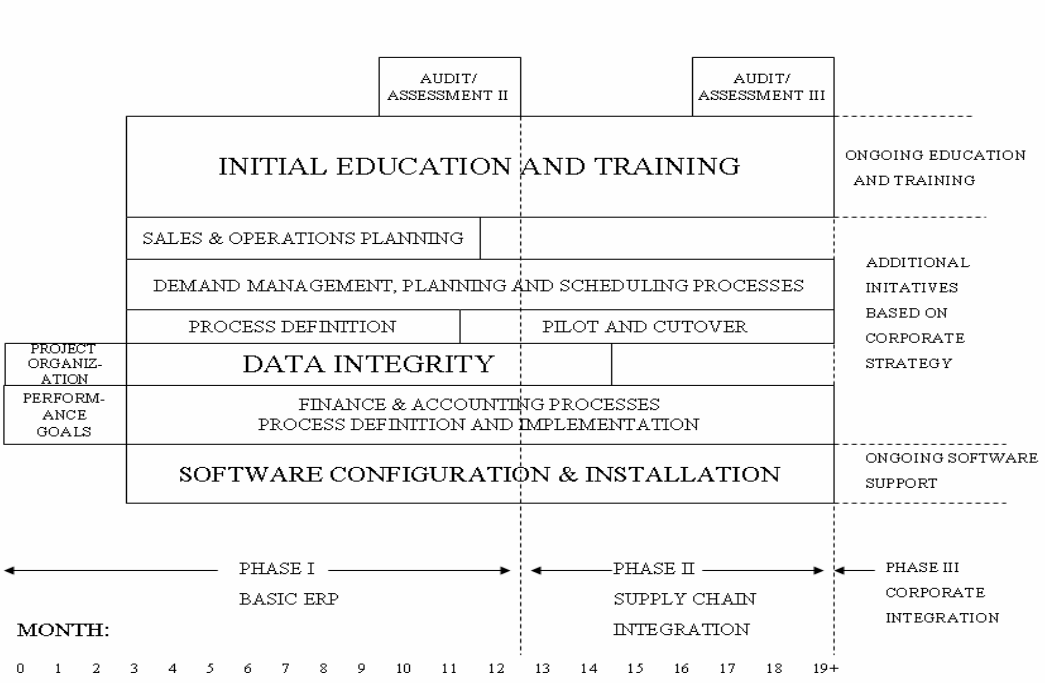

Figure 2.7. ERP Proven Path (After: [8])

Developed by Daryl Landvater in the mid-1970s, the Proven Path is a set of well-defined steps that an organization should take to successfully complete implementation phase I and II of the ERP life cycle. It is a methodology that is followed by integrators and has been proven to work because it properly aligns with the priorities of an ERP. The priorities for making an ERP implementation successful are people, data, and computer. People within the organization are the first priority because of the change that is going to take place with an ERP. At all levels of the organization people are going to manage the

implementation and either back it or stand against it. Getting positive results is going to hinge on getting support for the change. Data is going to come out of the legacy systems and go into the ERP and therefore it is imperative that this data is accurate and correctly structured. If it is not then a "garbage-in, garbage-out" scenario will result. The last priority of ERP is the computer which encompasses both hardware and software. ERP is a software initiative and it must be installed and configured correctly for it to work as planned. Set to a 19-month implementation timetable, the Proven Path adheres to an aggressive schedule because the attention spans of both organizations and people are limited. Any one project can only hold the top priority in an organization for so long. The monumental shift to an ERP requires that it be the top priority. Since it is unlikely that is can hold this position for three or four years, the best tactic is to implement it quickly.

a. Project Organization

After an ERP vendor and an integrator have been selected, the first step on the Proven Path is project organization. This is where the project leader and his staff will be selected and the implementation plan will be developed.

b. Performance Goals

Along with establishing the plan, the project team will also come to an agreement about the goals of the project. Specifically, categories of the business that are to be improved will be delineated and the levels of performance those categories are to reach will be established.

c. Initial Education and Training

Given that people are the first priority in an ERP, educating the people in the organization about the change is the top priority in the Proven Path. The goal should be to educate 100% of the people affected by the ERP. At a minimum, 80% of those people have to be educated. They need to understand why the organization is making the transition, what the benefits are and what will be expected of them. If people are going to be required to change the way they work, the benefit to doing so must be clearly

communicated. Additionally, the powerful entities within the organization should be educated on the pitfalls of an ERP so they can help the organization avoid them.

d. Sales & Operations Planning

Once education is underway, the sales and operations planning (S&OP) portion the ERP can begin implementation. This is first behind education because it involves relatively few people but it is the main driver behind the functioning of the organization. The sales forecast is a prediction of what is going to be demanded by customers. From this prediction, the operations plan is set in motion to produce what will be demanded. In essence, the S&OP encompasses what the organization does and in an ERP it is the most important element. Thus, it is the first element in the implementation phase.

e. Demand Management, Planning, and Scheduling Processes

Underneath S&OP is demand management, planning, and scheduling. Whereas S&OP covers what is going to be required at the highest level, demand management, planning, and scheduling is the detail information that goes into the top-level forecast. It includes the mix of products that should be made and the specific customers that are going to receive those products. Additionally, the new approaches to forecasting demand and order entry are covered in this step. The processes are defined and a pilot is used to demonstrate those processes. Once the pilot is proved successful, it will be implemented and a new customer order entry, forecasting, and detailed planning and scheduling processes will be running.

f. Data Integrity

Checking the integrity of the data going into the ERP will commence at project initiation and continue throughout much of the implementation schedule. Due to the fact that ERP requires a level of data integrity that is so high, this step can not be underestimated. It is arduous detail oriented work but if it is not done properly, the ERP will produce the wrong information.

g. Finance and Accounting Processes

Every action taken by an organization has financial implications. In commercial entities, the accounting standards that must be adhered to are well understood and codified in ERPs so this step takes lower on the scale of importance in the Proven Path. However, for a public organization, the financial processes that are to be followed are not as transparent. Either way, the financial processes must be continually defined all the way through implementation.

3. Extending Value

At the completion of the proven path, the organization can make the decision to add the additional features that have come on the market to enhance their ERP. This is the step where the particular divisions get those "nice to have" items that are not part of standard ERP. Items such as Customer Relationship Management (CRM), Supplier Relationship Management (SRM), and Business Intelligence software are costly additions to the functionality of the core ERP [40]. The extensions selected should align with the strategic goals of the organization. Integration of the ERP with a higher level of the corporation or public entity also takes place during the extending value phase of the life cycle.

4. Maintaining Value

Five to seven years after the beginning of the ERP project, the maintenance phase of the life cycle is entered. During the maintenance phase, the aim is to get as much life out of the ERP as possible. An additional five to ten years is ideal. Small improvements will be made as business needs change but no major modifications take place [40].

5. Declining Value

At some point the business changes have outgrown the existing ERP. Technological advances have changed the landscape and now the organization must change again to remain competitive. Approximately twenty years after starting the ERP project, in the declining value phase it is time to begin preparations to start the ERP life cycle again [40].

III. ERP IN THE DOD

A. BACKGROUND

The supply chain problems of the first Gulf War, the ERP success stories of the private sector and the legislation passed during the early to mid 1990s steered the DOD toward ERP as a viable means of correcting the deficiencies of the Department's Cold War era business systems. In 1997, two internal DOD documents were published that emphasized that the time had come to transform the Department's business environment and systems.

1. The 1997 Quadrennial Defense Review

The first document to outline the path toward transformation was the 1997 Quadrennial Defense Review (QDR). In the QDR, the senior DOD leadership outlined the current state of the Armed Forces and defined the direction the Department needed to go to face current and future global threats to U.S. security. The 1997 QDR focused on this purpose but it also contained a description of the plan to implement "focused logistics" [42].

Figure 3.1. Full Spectrum Dominance (From: [43])

First defined in the DOD's Joint Vision 2010, "focused logistics" is one of the four pillars of "full spectrum dominance". As a military concept, "full spectrum dominance" implies a capability to control all elements of the physical battlespace, electromagnetic spectrum and information space using a combination of land, air, maritime and space based assets. By controlling these elements, the U.S. would be able to prevent the opposing force from operating in these realms [43]. The "focused logistics" portion of the operating concept envisioned the services and civilian defense organizations working jointly to provide the operating forces precisely the supplies they need when they need them.

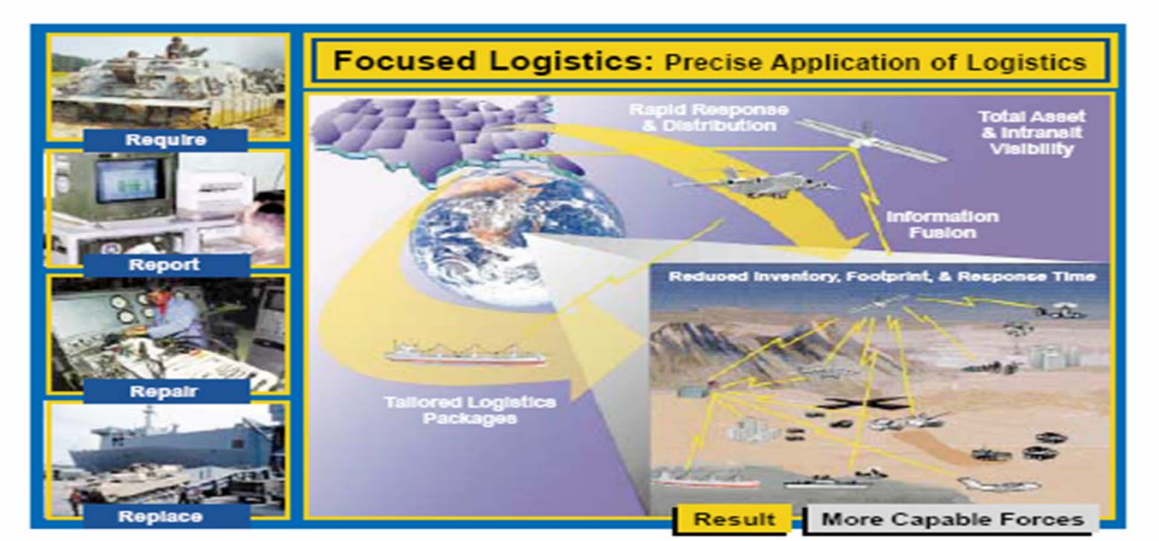

Figure 3.2. Focused Logistics (From: [43])

To achieve "focused logistics," the DOD planned to leverage the supply chain information systems and business processes of the civilian sector. In the 1990s, the commercial sector was continually getting "leaner" by carrying smaller inventories and using IT to deliver products to customers at the exact time needed. For many of the commercial companies capable of the supply chain practices sought by "focused logistics", The IT enabler of the advanced supply chain business practices was an ERP.

Placing "focused logistics" as one of the four pillars of Joint Vision 2010 demonstrated that the DOD intended to make a significant investment in improving the way it performed supply chain management. After being revealed in Joint Vision 2010, the plan to invest heavily in developing state-of-the-art logistic practices and doctrine was

confirmed in the 1997 QDR. The QDR stated that "focused logistics will reduce the overall size of logistics support while helping to provide more agile, leaner combat forces that can be rapidly deployed and sustained around the globe" [42]. This statement clearly demonstrated the shift from the mass inventory methodology of the first Gulf War. In the late 1990's, the DOD planned to put money into ERP systems capable of providing more responsive logistics support.

2. The 1997 Defense Reform Initiative

After the release of the QDR, the second document published in 1997 to outline the course toward transformation was the 1997 Defense Reform Initiative (DRI). Chartered by the Secretary of Defense William Cohen, the purpose of DRI was to study changes that must be made to the DOD business systems to better meet the requirements of the operating forces. The concluding report of the study authorized the services and DOD support agencies to begin IT projects to acquire systems that will help the Department perform "just-in-time" logistics. Logistics where critical supplies and spare parts are not stockpiled just-in-case they are needed but rather are delivered when needed. The report states, "Just-in-time logistics is revolutionizing the private sector and can do the same for the DOD" [44]. To execute "just-in-time" logistics, the service components and DOD logistics components needed to abandon the paperbound logistics systems of the past and embrace the IT systems of the private sector.

B. DEPARTMENT OF THE NAVY

Given the high level guidance of the 1997 QDR and DRI, the Department of the Navy (DON) began to look for the best way to achieve the state-of-the-art logistics capability called for in Joint Vision 2010. Additionally, the Navy wanted systems that could lead to compliance with the Federal Financial Management Improvement Act of 1996. In order to meet the requirements of the FFMIA, the systems would have to "… comply substantially with (1) federal financial management systems requirements, (2) applicable federal accounting standards, and (3) the U.S. Government Standard General Ledger (SGL) at the transactions level" [1]. Essentially, what the Navy was looking for

was systems that would make the supply chain processes more agile and responsive and provide accountability of funds to American taxpayers.

1. Revolution in Business Affairs

To achieve this objective, the first thing the Navy did was establish an executive committee in December 1997 that was held responsible for looking for ways to transform DON business affairs and systems. The committee was dedicated to what the Navy called a "Revolution in Business Affairs (RBA)" [2]. A revolution where the Navy planned to change the way it traditionally did business in favor of more modern approaches.

2. Commercial Business Practices Working Group

A goal of the committee for the RBA was to investigate the systems that were being used in the commercial sector that provided the information backbone of the modern business approaches. The RBA committee did this by forming a separate sub-committee named the Commercial Business Practices (CPB) Working Group. Made up of personnel taken from financial management organizations throughout the DON, the CPB working group recommended that ERP systems should be used to drive the change that was sought [45]. Based upon that recommendation, six ERP pilot programs were authorized but due to a lack of funding, only four pilot programs proceeded. The four pilot programs that received funding included [2]:

- SMART- Aviation Supply & Maintenance: maintenance planning and supply support processes sponsored by the Naval Air Systems Command (NAVAIRSYSCOM) and the Naval Supply Systems Command (NAVSUPSYSCOM).
- SIGMA- Acquisition Program Management: program management processes to include linkage between contracting and financial systems sponsored by the Naval Air Systems Command (NAVAIRSYSCOM).
- CABRILLO- Navy Working Capital Fund (NWCF) Financial Management: management of the Navy Working Capital Fund within acquisition commands sponsored by Space and the Naval Warfare Systems Support Center San Diego (SSC-SD).
- NEMAIS- Regional Maintenance: avionics and repair center processes across surface, air, and subsurface communities sponsored by the

Commander in Chief Atlantic Fleet (CINCLANTFLT) and the Naval Sea Systems Command (NAVSEASYSCOM).

3. Commercial Business Practices Executive Steering Group

At the beginning of the projects in December 1998, the Navy established a (CBP) executive steering group to monitor the activities of the pilot projects. The executive steering group monitored the projects but did not manage the projects. Since the projects were individually funded by the sponsoring commands, they were individually managed by the sponsoring commands. Furthermore, the separate sponsors had different business concerns based upon the particular business function of the supporting activity [45]. For example, SSC-SD is a Working Capital Funded (WCF) organization and because of this role, it was assigned responsibility for judging ERP's ability to manage government financial management. Specifically, SSC-SD was to judge the following areas [2]:

- Financial management- All financial activities including budgets, funds management, billings, payables, reporting, and employee data.
- Procurement management- All buying activities for maintenance, repair, and overhaul items, from issuing a purchase order, receipt of goods, and processing vendor invoices.
- Asset management- Including both real property and improvements. Tracking all assets from acquisition to disposal.
- Project management- Fully integrated project management systems that tie together project management tools with finance, budgeting, procurement, and asset management data.
- Strategic management- Planning and budgeting tool for both annual and long range planning. It will build upon annual budgeting and planning needs to develop a long-range orientation for SSC-SD.

4. ERP and Integrator Selection

The plan followed by the project teams at the separate sponsoring commands adhered to the steps of the ERP life cycle. A business case analysis (BCA) was conducted at each of the commands to outline the vision of what the organizations were attempting to achieve with their ERPs. The BCAs accomplished this task by outlining the "As Is" business processes of the commands and then compared those processes to the business processes of an ERP. A side by side comparison revealed the differences in the way the work would be performed with an ERP and highlighted the areas where

processes would be reengineered and improved by the ERP. The reengineered business processes of the ERP were labeled the "To Be" business models [2].

Once the vision of what the sponsoring activities wanted to achieve was outlined in the "To Be" business models, it was time to select an ERP vendor that best fit the model. All of the pilot programs selected SAP's R/3 (Release 3) software for their projects.

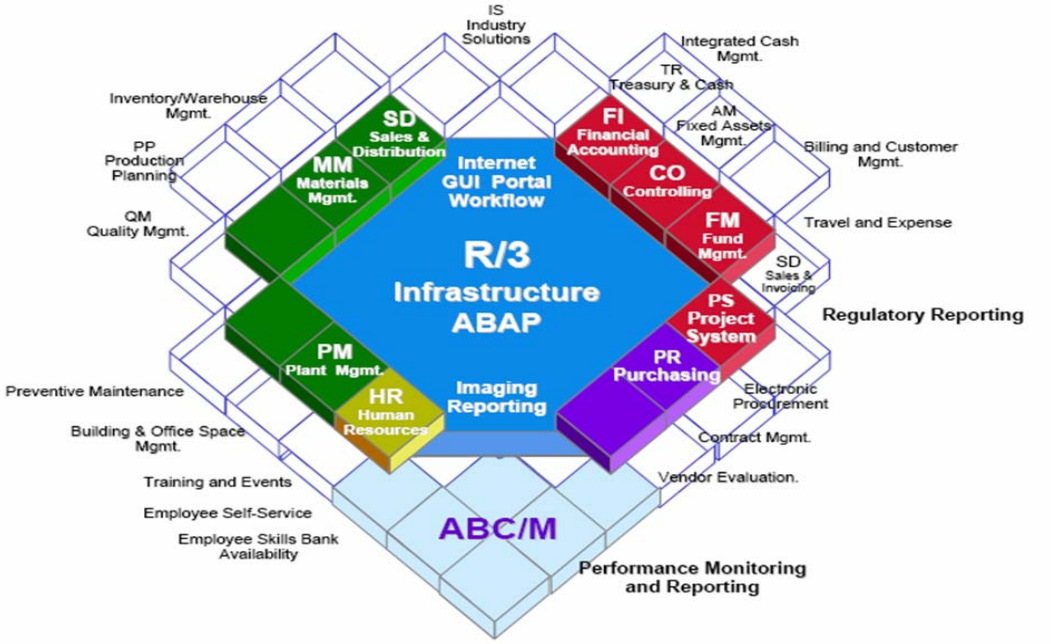

Figure 3.3. SAP R/3 Architecture (From: [2])

The R/3 architecture was chosen because the different business areas of the system are divided into modules which allow for certain function points to be implemented while others can be excluded or left for implementation at a later time. This provides the user with the flexibility to implement in stages thereby reducing the risk associated with implementing a system in a single release. Additionally, at the time of the decision in the late 1990s, the R/3 software was the preeminent software selected by the U.S. Government customers. It was the ERP software of the U.S. Mint, the Strategic Petroleum Reserve and most importantly, it was the ERP software the U.S. Army planned to use for the Logistics Modernization Program [LMP] that was underway at the same time as the Navy pilots [3]. This is important because the overall goal of Joint Vision

2010 was joint operations to include joint logistics. Thus, if the systems were to be tied together at some point in the future, it would be beneficial if they were all using the same platform.

Once the product evaluation phase has come to an end, the next step in the ERP life cycle (implementation phase I) involves the selection of a consulting partner (integrator). A big decision because the ultimate goal is to have a long term partnering relationship that has to thrive to keep the ERP project progressing. If the relationship turns hostile and the integrator can no longer be considered a trusted advisor, then an integrator change has to take place. When an integrator switch occurs, dramatic setbacks are the result because it takes time for the new integrator to get acquainted with the history of the project [46]. Each of the four separate Navy ERP pilots selected different vendors as integration partners for their projects. For the SMART pilot, the program management team opted to work the Electronic Data Systems Corporation (EDS) while SIGMA teamed with Bearing Point. SSC-SD selected Price Waterhouse Coopers for the CABRILLO project and IBM was chosen as the integrator for the NEMAIS pilot.

5. Pilot Results and Road Ahead

Between late 1998 and early 2002, the four Navy pilots took different routes with their integrators exploring the application of ERP to their business areas. During the course of the projects, issues surfaced that required the attention of Navy personnel higher than the heads of the Systems Commands sponsoring the individual pilots. The main issue that needed attention: what should be done to integrate the pilots after they had achieved their independent objectives? This led the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RDA) to establish a single ERP program in August 2002. The goal of the program was the convergence and replace of the four pilots by fiscal year 2008 [45].

When the decision was made to proceed with a single Navy ERP program, a central program office was founded to manage the converged ERP. In the beginning of this convergence process, the program office undertook extensive software architectural planning due to the fact that the project team was tasked with merging established ERP

solutions. A task that is much harder than starting an original ERP project because of the care that must be taken to maximize use of the existing SAP instances thereby minimizing re-work.

To make a single ERP solution out of the four pilots a reality, the designers of the architecture have approached the project from the perspective that it is like going live with an ERP in two divisions of a large company and then merging the divisions into a single system. This is typical of the work that has to be done following the acquisition and mergers of separate companies. However, before convergence of the systems can begin, a vision of the capability that the converged solution is supposed to deliver must be established as a target for what the project team is trying to achieve.

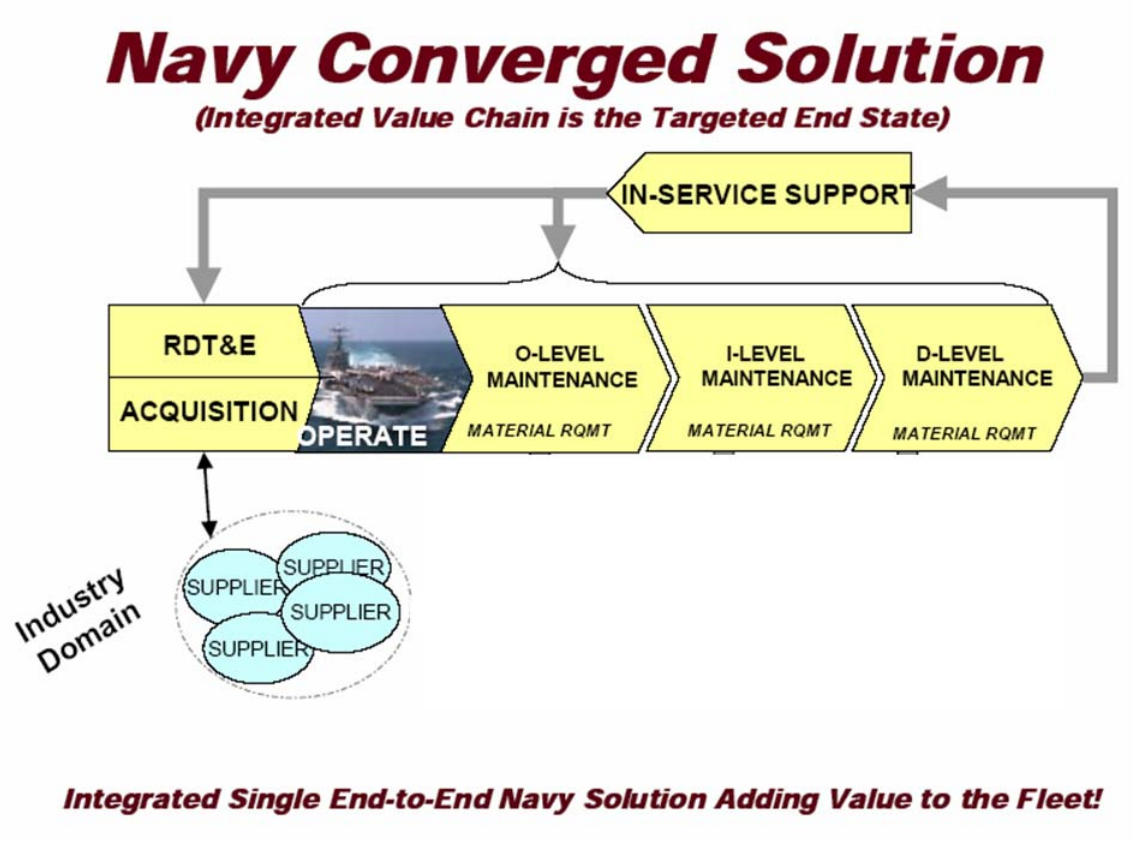

Figure 3.4. Navy Vision for a Converged Solution (From: [47])

For the Navy, the vision of the converged solution aligns with the Product Lifecycle Management (PLM) approach that is used in industry to manage products from acquisition to disposal. In this case, the products to be managed are the major end items

that are procured to support the Navy's mission. The person responsible for PLM in the commercial sector is the product manager. A position that is mirrored in the DOD by the program manager who "… is responsible for managing the complete weapon system life cycle, which includes concept development, R&D, acquisition, testing, initial fielding, sustainment (including maintenance), in-service support, and disposal" [47].

In their effort to achieve the end-state of a single ERP that manages major end items from "cradle to grave", the Navy has to overcome the fact it has two separate SAP instances (SIGMA and SMART) managing aviation assets and another SAP instance (NEMAIS) managing maritime assets. The plan developed to handle this situation in the most cost effective and risk-minimizing manner calls for the merger of the two aviation projects (SIGMA and SMART) into a single instance while NEMAIS will be expanded to manage all maritime assets. Integration between the systems will occur because SAP was designed to control business functions that flow across organizational divisions which in this case is the Navy Systems Commands (SYSCOMS). It does this by artificially dividing the software to allow for organizational boundaries while business processes between the divisions flow uninhibited across the organizational boundaries. A graphic of the arrangement that is envisioned is depicted below.

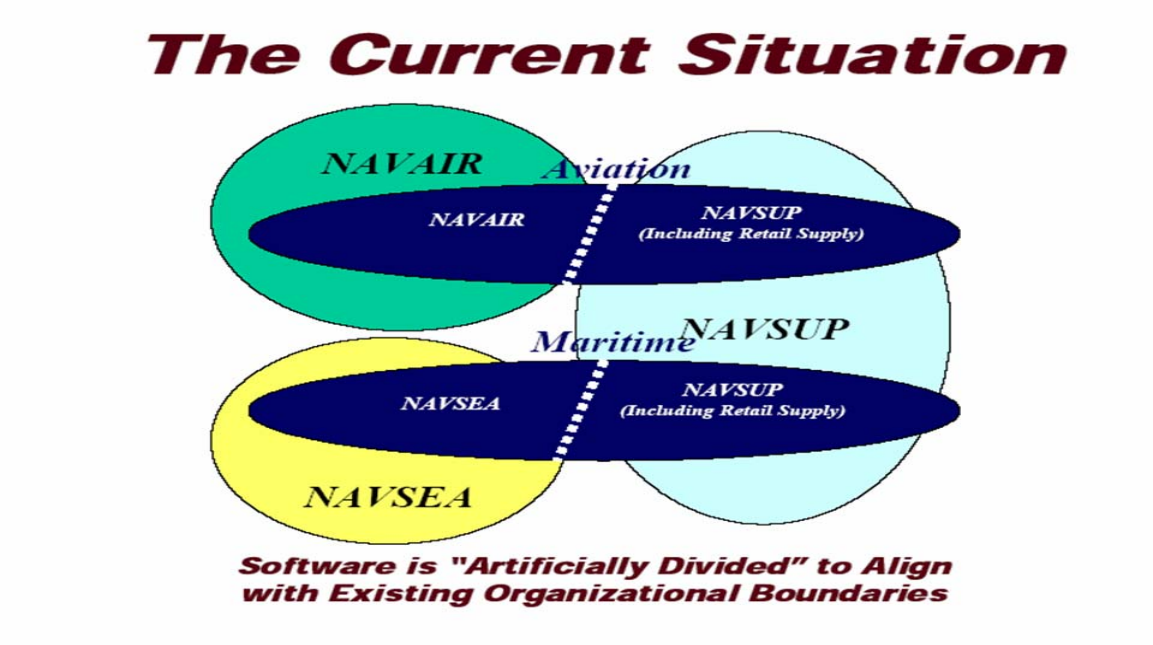

Figure 3.5. Current Navy Situation (From: [47])

The end-state that the Navy is currently working towards is an operational architecture with two value chains (aviation and maritime) that manage the life cycle of weapons systems from beginning to end. Both value chains will be include concept development, budgeting, acquisition, testing and evaluation, maintenance, in-service support, and disposal as well as all the supporting business processes associated with these activities. Essentially, the two value chains will conduct the same business processes outlined in Figure 3.4 with a different look and feel to maximize the use of the work that was conducted on the separate pilot projects. The CABRILLO project of SSC-SD will remain separate from the envisioned architecture because as a Working Capital Fund organization, the financial process of SSC-SD does not match the financial process of the other SYSCOMS. Therefore, CABRILLO will operate as a stand-alone financial stovepipe system [47].

C. DEPARTMENT OF THE ARMY

Like the Navy, the U.S. Army immediately went to work on focused logistics following the release of the QDR and DRI. In August 1997, the Deputy Commanding General of the Army Material Command (AMC) issued a memorandum to the Communications-Electronics Command (CECOM) that asked the command to [3]:

a. Determine feasible alternatives for logistics modernization strategies,

b. consider the implications and devise methods to soften the impact on the existing workforce,

c. develop a performance-based statement of requirements, and

d. to recommend an acquisition approach.

Specifically, the Commanding General wanted the CECOM to form a project team tasked with conducting market research to explore the IT systems being used by the commercial sector. The overall vision the General was working toward was an AMC that integrated the best practices and technologies of the private sector to transform the Army's wholesale logistics automation systems.

1. The CCSS and the SDS

Written in Common Business Oriented Language (COBOL), the Commodity Command Standard System (CCSS) and the Standard Depot System (SDS) are the wholesale logistics automation systems the General was referring to. The purpose of these systems was to support the Army's annual procurement of supplies and equipment from commercial vendors, the General Services Administration (GSA) and Defense Logistics Agency (DLA). A big problem with the systems is that as of August, 1997, the technology being used was thirty years old. The systems were being maintained by CECOM funded federal IT employees who worked at two central design activity (CDA) logistics centers in St. Louis, Missouri, and Chambersburg, Pennsylvania. It was these programmers that the General wanted to "…soften the impact on…" if it was decided that it was in the best interest of the AMC to adopt commercially available IT systems.

The problem with the CCSS and the SDS had more to do with their inflexibility and unresponsiveness than their age. In their analysis, the project team at CECOM tasked with planning the approach the Army should take with their business system transformation concluded that the weaknesses of the CCSS and SDS systems are [48]:

- *Lack of flexibility*: Process changes, regulatory changes, and reorganizations within and between user commands require expensive and extensive data conversions and programming changes.
- *Slow, unfocused reports*: Reporting and summarization capabilities are geared to workers. Managers and executives, with their need for easily specified, flexible, tailored, and rapid generation of reports and summaries are usually frustrated with output capabilities.
- *Difficult to use*: The system is not user friendly. The system relies on extensive use of codes to provide compact storage (a holdover from the time when computer storage was inordinately expensive). Users are required to learn codes and have extensive system knowledge. The system lacks adequate data edits and validations, as well as support functions.
- *Expensive to maintain*: The system's size and complexities make it difficult to manage and change code. Large portions are based on relatively old third-generation programming languages and flat data structures that are inflexible to change and inefficient to operate.
- *Unresponsive*: The use of batch processing precludes timely updates to data architecture, flexible data retrieval capabilities, and informed decision-making.

- *Outmoded database*: The use of outmoded database systems and architecture result in rampant data inconsistencies, data duplication, and the lack of data standardization.
- *Expensive to operate*: The system requires extensive manual intervention because of outmoded data and system architectures.
- *Lack of cost-sharing*: The Army is the only "bill payer," precluding the ability to leverage existing industry investments in modern logistics processes and IT.

After identifying the problems with the legacy systems, the project team had to come-up with a solution using the $426 million operating budget that was set aside for operations and maintenance of the existing systems for the period between 1997 and 2007. As was done with the Navy pilot projects, the Army planned to use the operating funds of the sponsoring command to fund the transformation effort. In the Army's case, the sponsoring command was the AMC.

3. The Army's Plan to Modernize

Three alternatives were devised by the CECOM project team to achieve the reengineered logistic processes and modernized systems. The first alternative was ruled out because it did not meet the cost constraint and the schedule was deemed too lengthy. Alternative two was a financially viable option but there was no "soft-landing" for the 478 federal programmers at the two CDAs. Consequently, it was feared that a hostile relationship would develop between the contractor personnel and the CDA employees. A situation that would likely result in government employees sabotaging the program. The last alternative was the only option that met the mandate of a "soft-landing" for the CDA programmers and fell within the budgetary guidelines.

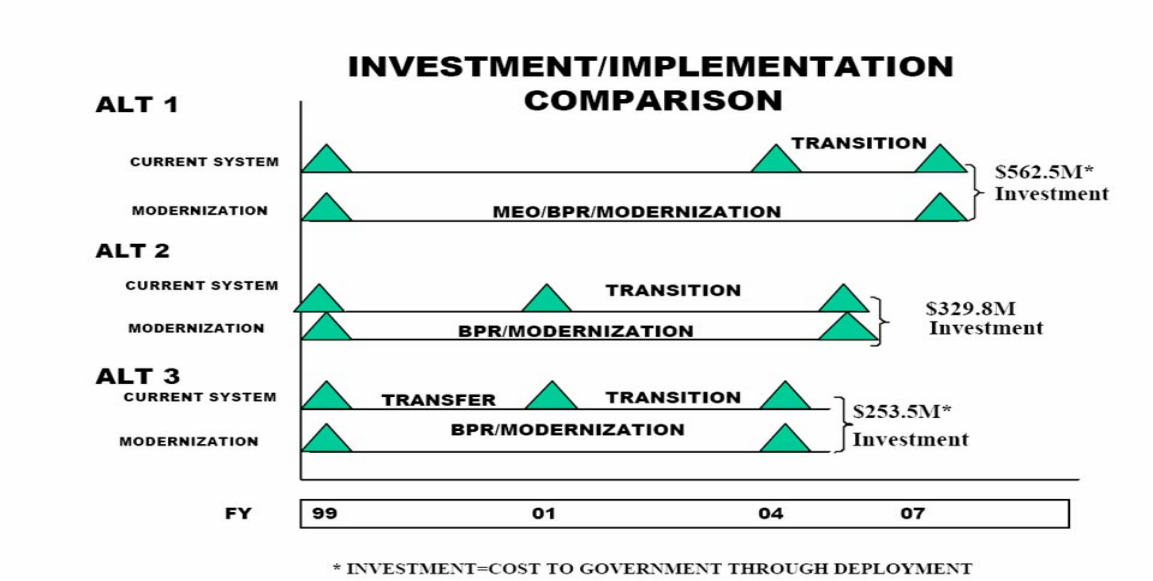

Figure 3.6. Investment/Implementation Comparison (From: [3])

In the seven year period between fiscal years 1999 and 2005, the modernization project would cost $253.5 million. The ten year cost of the project (1999 to 2009) was projected to be $420.9 million. A savings of $4.3 million would be realized and the federal programmers would receive their "soft-landing" because "Under alternative three, the soft-landing was an arrangement in which the winning contractor would agree to employ the government employees affected by the transition for a pre-specified period of time, offering competitive pay and benefits" [3]. Alternative 3 had the lowest price tag because the winning contractor would have to be willing to operate at a loss during the system development phase (through FY-2005) while the new system is being built and the old systems are still being maintained. The winning contractor would recoup their losses over the life of the contract because they would be awarded the contract for the full ten years and receive all of the $420.9 million. Losses would be offset in the later years by gains that would be realized due to the efficiencies of the new system.

3. Privatization

Translating the plan outlined in alternative three into reality required privatization because the plan called for the movement of government equipment and personnel into the private sector [49]. In the Spring of 1998, the privatization plan encountered resistance from the Office of the Secretary of Defense (OSD) who told the project team

that what they were planning was an outsourcing initiative and thus, the team would have to follow the guidelines established in the Office of Management and Budget (OMB) Circular A-76. The A-76 mandates that federal employees be allowed to compete against private companies for a contract such as the one proposed. A downside of the competition is that if the federal employees lose the competition, they also lose their jobs [49]. The project team did not want such a competition to occur because they knew that the CDA employees did not have the business process reengineering and IT skills necessary to successfully compete for the contract. If they lost the contract and lost their jobs, the team would have failed to provide them the "soft-landing" that the AMC Commanding General desired. Therefore, the project team began to look for a way around the requirements of the A-76 and found what they were looking for in the Circular itself. The Circular contains a clause which allows for agencies to submit an application for a waiver if there are extenuating circumstances. Using the CECOM attorneys, the project team drafted their waiver request containing the justification for their acquisition approach. The waiver was the first ever submitted and was approved by the DOD chain of command in April 1999 [3].

4. The Union Battle

Upon notification that the waiver was approved, the CDA employees began to fight in order to stop the process. Many of the employees did not want to transition out of the federal workforce and the St. Louis workers were unionized under the National Federation of Federal Employees (NFFE). The NFFE filed an appeal with the Army in May 1999 and got the attention of the Congressional representative in St. Louis, Dick Gephardt. Though not under a union, the Chambersburg CDA employees also got the attention of their Congressional representative and the battle to keep the project alive got underway in Washington. Using the logic that outsourcing was the only way the Army was going to make a significant transformation, the project team beat out the resistance. In addition to the reason in the argument, the fact that the project team had developed a plan to take care of the Government employees helped to win over lawmakers and the DOD leadership. On September 30, 1999, the Secretary of the Army rejected the NFFE appeal and the project moved forward [50]. Due to the fact that the Army secretary was

the ultimate authority in the decision, his rejection ended the fight. Still, when the time came for the CDA employees to accept job offers from the winning contractor, only 205 of the nearly 500 civil service employees went to work on the project. The others opted for early retirements or transferred to a different federal sector [51].

5. The WLMP Gets Underway

With the demise of the CDA employee resistance in the Fall of 1999, the only thing left to do at the end of that year was award a contract. On December 30, 1999, the AMC selected the Computer Sciences Corporation (CSC) as the integrator for the Wholesale Logistics Modernization Program (WLMP) more commonly referred to as the Logistics Modernization Program (LMP) [3]. The task assigned to CSC: "…provide business process re-engineering services for the Army's current wholesale logistics processes and supporting IT" [52]. To accomplish this task, the system chosen was the same system selected for the Navy's pilot's, SAP's R/3. CSC immediately went to work on the LMP and by November 2002 end-user training and testing was underway with test designed to see if the LMP met the requirements established for it by the AMC [53]. Having passed the initial testing, LMP deployment occurred in February 2003.

6. SALE

While the LMP project team was handling wholesale logistics support, the AMC got started working on the retail side of the support equation. Retail customers are the field-operating commands that support Army units in combat. They are the units that requisition the supplies from the wholesale level that is holding the inventories of stocks. Both the retail and wholesale projects were started in the late 1990s. However, the programs were divided because the plan for what was to be done with the federal employees responsible for development and maintenance of the legacy systems was different. As was discussed previously, the wholesale programmers at the two CDA were to be retired, transferred or handed over to the winning contractor. Unlike the legacy wholesale environment which had two main programs (the CCSS and SDS), the legacy retail environment contained sixteen separate programs with thousands of federal employee programmers. This problem led to the decision that the federal employees

should continue to operate the legacy systems while working with a contractor to develop a new system [51]. Work on the new system began in 1999 but it has had a much lengthier development timeline than the LMP because of the transitional approach taken.

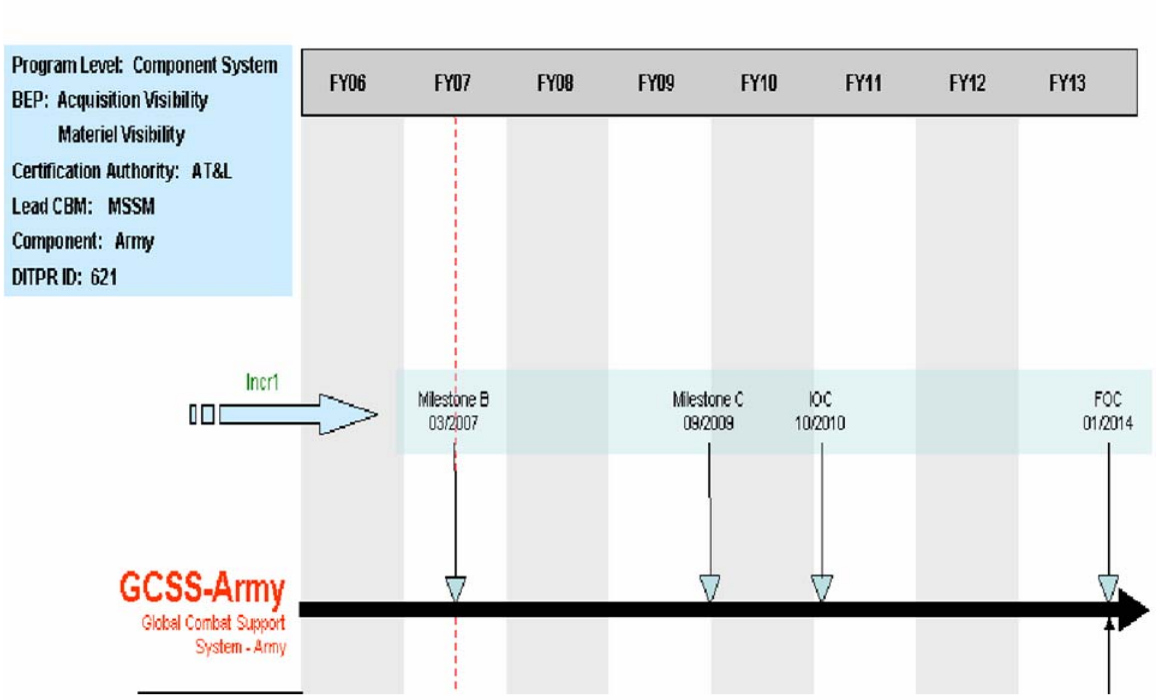

Figure 3.7. GCSS-Army System Migration Diagram (From: Ref. [54])

Titled Global Combat Support System-Army (GCSS-Army), the retail project is still in the early stages of development having only met Milestone B of the Integrated Defense Acquisition, Technology, & Logistics Lifecycle Management Framework in March of 2007. The vision for GCSS-Army is that it will provide the Army supply clerk embedded with the fighting forces a single application for tactical logistics at home and overseas. It will achieve this end-state by slowly transferring the capabilities of the multiple systems currently in use into a single system running on an SAP R/3 framework. The framework currently in development has been specially designed and standardized with other Joint and NATO partners to meet the requirements of the modern battlefield [55].

When the LMP and GCSS-Army are brought together, they will form the Single Army Logistics Enterprise.

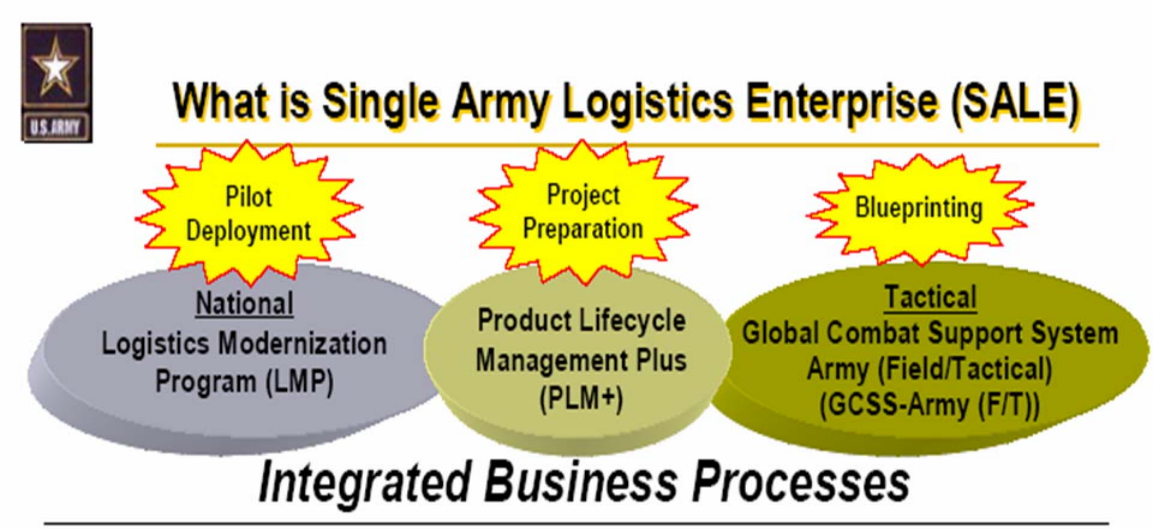

Figure 3.8. What is Single Army Logistics Enterprise (SALE) (From: [55])

There is an additional entity in the SALE architecture that will act as the integrating hub between the LMP and GCSS-Army. Product Lifecycle Management Plus (PLM+) is a copy of what was seen in the Navy's Converged ERP Solution and ties the whole system together by structuring the data so that every aspect of the life cycle of a weapon system can be viewed in one system. Using SAP's Master Data Management (MDM) technology, the SALE mandate calls for just one common SAP enterprise controlling all the logistics data and managing the interfaces to external sources that have technical data or information of value to those involved in the life cycle of Army equipment and supplies. Integrating the LMP, PLM+ and GCSS-Army will achieve the overall vision of SALE which is "A fully integrated knowledge environment that builds, sustains, and generates Warfighting capability through an integrated logistics enterprise based upon collaborative planning, knowledge management, and best business practices" [55]. The teaming arrangement between the Army and CSC to achieve a SALE running on an SAP ERP is the future of Army logistics. It is anticipated that this will be realized with full operational capability in 2014.

D. DEFENSE LOGISTICS AGENCY

Established in 1961, the Defense Logistics Agency (DLA) falls under the control of the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD/AT&L) [56]. The role of DLA in the DOD is as a centralized intermediary supply

support agency that procures consumable items from the commercial market and then distributes those items to the separate service components. "DLA's critically important role in national security is clearly reflected in the fact that the military services rely on the agency for 100 percent of their subsistence items, medical material, construction and barrier material, footwear and protective garments…all the essentials of personal readiness" [57]. For the major end-items that the military services fly and drive such as planes, tanks, planes, and trucks, DLA provides close to 95 percent of the repair parts that are required to keep these items operational. The agency is able to accomplish its mission through a requisitioning system where the customers (military services) determine their consumable requirements and then submit orders to DLA. Depending upon the material requested, the order will be forwarded to one of four supply centers for action. In the U.S., the four supply centers operated by DLA are [56]:

1. Defense Supply Center Columbus, Ohio, which is responsible for land, maritime, and missile support;
2. Defense Energy Support Center, Fort Belvoir, Virginia, the lead center for comprehensive energy solutions, such as contract support and the management of petroleum-based fuels;
3. Defense Supply Center, Richmond, Virginia, which is responsible for air, aviation, and space support; and
4. Defense Supply Center, Philadelphia, Pennsylvania, the lead center for troop support items, such as food, clothing, and medical supplies.

Upon receiving a requisition at a supply center, the center will meet the need in one of two ways. It will either be directly shipped or released from the commercial vendor who provides the material or fuel, or it will be distributed to the customer out of one of the DLA's owned distribution depot.

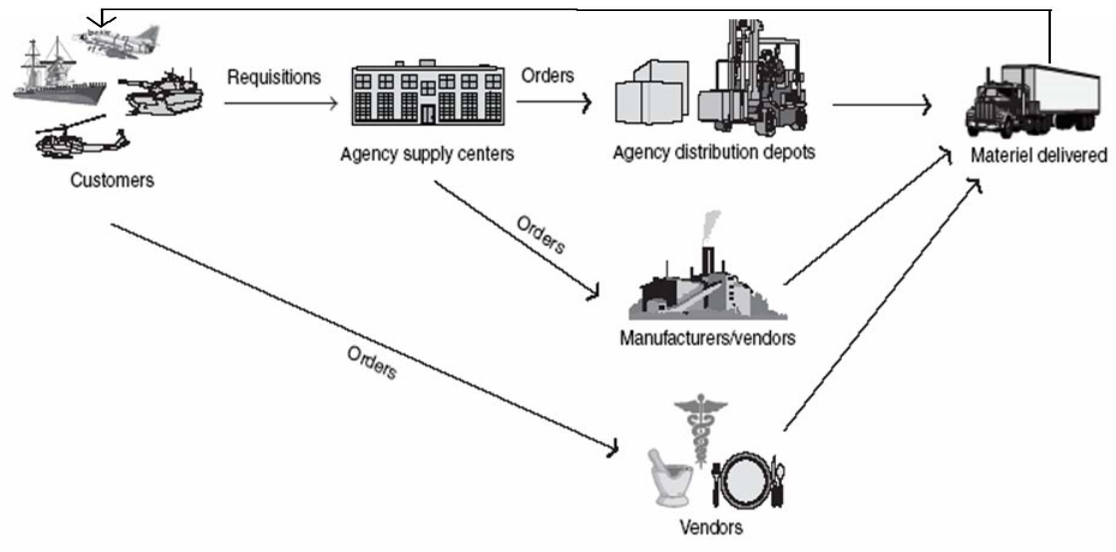

Figure 3.9. DLA's Supply Chain Management Process (From: [56])

In addition to supporting military end-items while they are in operation, the DLA is also instrumental when the items reach the end of their lifecycle. At the end of military equipments "functional life" or when it is no longer of value to the owning organization, it is turned over to a DLA Defense Reutilization and Marketing Office (DRMO) for reuse, reutilization, or disposal.

1. Business System Modernization

As the "…bridge between the warfighter and the American industrial base…" [57], it was clear to DLA leadership when the QDR and DRI were published that the agency was going to play a key part in "focused logistics". Prior to the release of these documents, DLA had concentrated on being a manager of the physical inventories that it carried in controlled depots. Since the focus was internal, the systems used were also developed internally. The future of DOD logistics that was mapped out in the QDR and DRI shifted the focus of DLA from an inventory management mindset to a supply chain management mindset [58]. Due to the fact that DLA holds such a pivotal position in the DOD supply chain, "focused logistics" would never become a reality if the Agency continued to rely on the thirty year old Standard Automated Material Management

System (SAMMS) and Integrated Subsistence Management System (ISMS). When compared to industry, DLA is a massive enterprise with a scope of business that includes [57]:

- 54,000 Requisitions/Day
- 8,200 Contracts/Day
- Number 54 on the Fortune 500
- Number 2 in Top 50 Distribution Warehouses
- 26 Distribution Depots
- 5.2 Million Items
- 24.7 Million Annual Receipts and Issues

With supply chain statistics similar to the behemoths of industry, the logical decision was for DLA to look to industry for answers on how to reduce inventory, deliver faster and lower IT costs.

In July 1998 DLA's Business System Modernization (BSM) program was born with the establishment of the Modernization Executive Board (MEB). The top-level objectives of the board were [59]:

- Replace Legacy Systems with commercial-off-the-shelf (COTS) software.
- Reengineer by fielding Best Practices.
- Improve customer service by collaborating with suppliers and customers.
- Provide Best Value Solutions.
- Provide the training, experience, and opportunity to succeed.

Following the ERP life cycle toward achieving these objectives, the first thing the MEB did was conduct a course of action analysis to determine if an ERP was an appropriate solution to transition DLA from inventory manager to supply chain manager. Having completed the exploratory phase in January of 1999, DLA's ERP project team began process mapping in April of 1999 to compare the DLA's traditional business processes versus the ERP business processes. In the summer of 1999, ERP vendors demonstrated how they would perform DLA's business functions. The system requirement were further refined in the Fall of 1999 and on December 21st, 1999, the

DOD approved DLA to move forward with the project and award a contract to a systems integration partner [56]. Accenture was selected as the integrator for the BSM in August of 2000 and awarded a $700 million contract to help DLA institute an enterprise-wide system [60].

2. The DLA's Plan to Modernize

To distinguish between the different categories of supplies, the DOD had separated the military supply system into a class of supply. The classes of supply are [57]:

- Class I (Subsistence)
- Class II (Clothing and Textiles)
- Class III (Bulk Petroleum)
- Class IV (Construction and Barrier Materials)
- Class V (Ammunition)
- Class VI (Personal Demand Items)
- Class VII (Major End Items)
- Class VIII (Medical Material)
- Class IX (Repair Parts)
- Class X (Non-military requirements)

In the DLA's implementation phase one of the BSM life cycle, the plan called for capturing the core processes related to the classes listed with the exception of Class III (bulk petroleum), Class V (ammunition), Class VI (personal demand items), Class VII (major end items), and Class X (non-military requirements). Class V, VI, VII, and X have never been the responsibility of DLA. Class III supplies were to be handled by the Fuels Automated System (FAS). Also a COTS software package, the FAS system was started as a parallel program to the BSM but it was developed solely to help DLA manage $5 billion worth of petroleum contracts each year [58]. Not including petroleum, the BSM blueprint was designed so that the ERP would fulfill DLA's core business

processes relating to planning, procurement, order fulfillment, and financial management for the other classes of supplies managed.

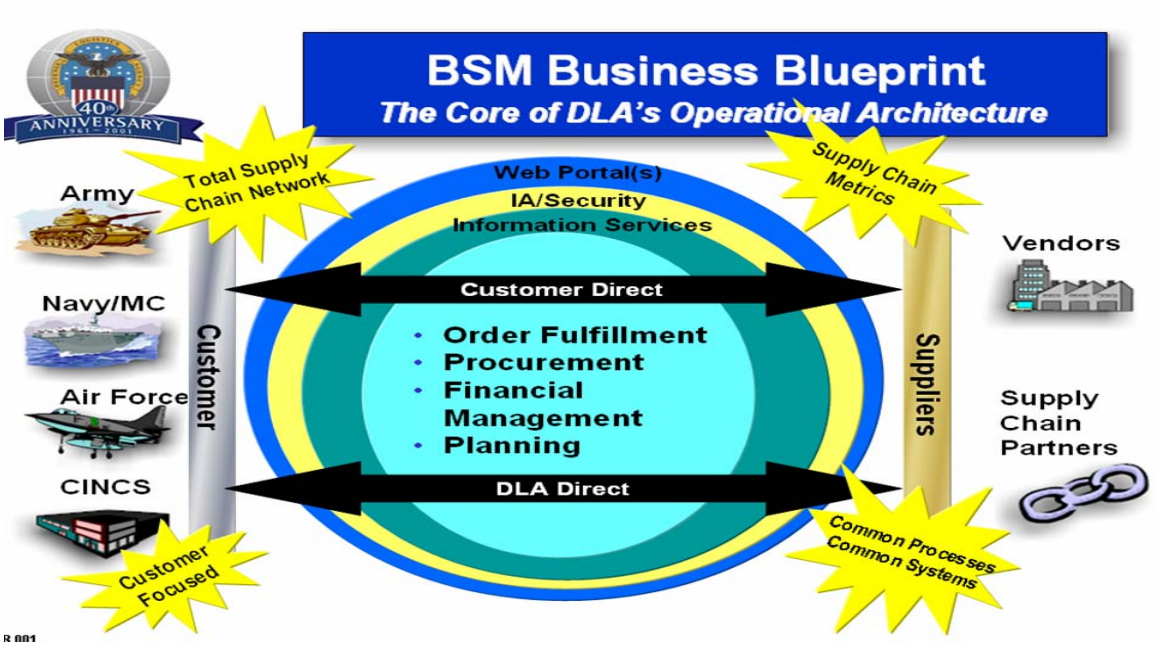

Figure 3.10. BSM Business Blueprint (From: [59])

Like the Army the Navy, DLA selected SAP R/3 software for the BSM ERP. Additionally, Manugistics and PD2 software was also chosen to supplement the SAP software. A Manugistics package was bought to manage demand history/forecast, develop the time phased inventory plan, create the supply plan, evaluate demand plan performance and optimize the distribution network. PD2 was procured to manage vendor master records, purchase requisitions and solicitations. It was also to be used for converting the supply plan and evaluating quotes. By purchasing these separate software platforms, DLA felt that it had achieved two of its top objectives: replace legacy systems with commercial-off-the-shelf (COTS) software and provide best value solutions.

Within each core business process, reengineering targets were established for the ERP so that the project would achieve two other top level objectives: reengineer by fielding best practices and improve customer service by collaborating with suppliers and customers. For the planning process the goals for reengineering included: demand for items should be set by the customer, a time-phased inventory plan, and a budget based on that plan. In procurement, the objectives were set at: tracking supplier performance and

supplier management, web-based procurement, and paying vendors upon receipt of material. Financial management was concerned with: FFMIA compliance, financials integrated with business transactions, and a change in inventory valuation methodology. Finally, to improve order fulfillment, DLA wanted the ERP to provide: time definite delivery, variable pricing, on-line account visibility and most importantly, to deliver material to the customer as promised. Requirements for the system were written so that scenarios could be run to test if these reengineering objectives had or had not been met by the software. Originally, the BSM project team scheduled full operational capability for the BSM in 2005. To successfully move forward through the aggressive schedule that was established, the system had to meet more than eighty percent of the functional requirements in the operational requirements document (ORD). Between 2001 and 2005, the program did fall slightly behind schedule. The actual schedule the BSM followed is outlined below.

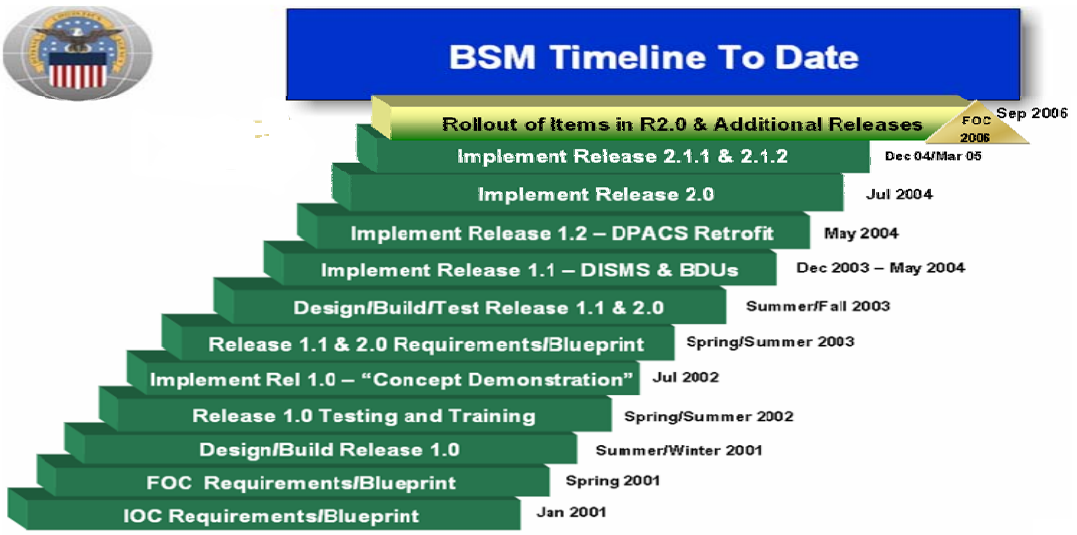

Figure 3.11. BSM Timeline to Date (From: [59])

3. Phase II and Future Projects

At the outset of the BSM, DLA intended to go beyond phase I of the ERP life cycle. As early as 2001, there was talk of transitioning into implementation phase II and beyond of the life cycle at the conclusion full operational capability (FOC) with the BSM [59]. FOC for the BSM was achieved in late 2006 and DLA is currently working hard to progress into implementation phase II and beyond as well as making plans for the extending value phase of the ERP life cycle. Eight key initiatives have been started to help DLA work toward the vision of being a critical enabler of "focused logistics." These eight initiatives are [57]:

a. Customer Relationship Management (CRM)

An extension of the ERP, a CRM system will help DLA structure and standardize customer relations so that issues are resolved in a timely and effective manner. A CRM is capable of doing this because it establishes a single enterprise-wide process for classifying customer issues and then managing those issues through resolution. The goal of a CRM is not just handling complaints and requests for status, they also provide sales and marketing services as well. By implementing a CRM system DLA is anticipating:

- Increased knowledge of customer's needs.
- Easier customer access to DLA.
- More timely and accurate reporting on key customer metrics.
- Tailored solutions based on customer unique needs.
- Enhanced ability to improve readiness and customer satisfaction at a reduced cost.
- Increased ability to support DOD strategies of Focused Logistics.
- Increased effectiveness in managing customer expectations and agency investments.
- Enhanced collaboration through collection and sharing information across the enterprise.
- Reduced customer complaints.

b. Supply Relationship (SRM)

Also an extension to the ERP, an SRM system enhances the ERP by delivering improved communication with suppliers so DLA can streamline the supply-chain and reduce inventory by having products shipped directly from vendor to customer. To make strong customer/supplier relationships requires a great deal of trust between organizations and an SRM system helps to build that trust by providing DLA "…more accurate insight into suppliers' capabilities and suppliers with more insight into DLA's needs" [57]. An essential enabler of this relationship is the Electronic Data Interchange (EDI) which links vendors and DLA so that requisitions can be passed straight to vendors for delivery without the need for the material to be received and redistributed by DLA. Also, a SRM system helps to track vendor performance so the Supply Chain Alliances (SCA) can be built with the vendors that habitually deliver quality products and services. All of the benefits to an SRM fall under the SRM umbrella.

Figure 3.12. SRM Umbrella (From: [57])

Over the course of the next several years, it is expected that DLA's SRM will:

- Reduce delivery times and total ownership costs
- Provide inventory savings
- Increase two-way communication with suppliers
- Leverage buying power across the enterprise

c. Distribution Planning and Management System (DPMS)

The DPMS is the delivery vehicle for dramatically improving the shipping processes used to get material into the hands of the warfighters. Using a combination COTS and government-off-the-shelf (GOTS) software, the DPMS will manage the movement of material in the Continental United States (CONUS) and outside the Continental United States (OCONUS). Customers and vendors alike will be linked into the DPMS and provided real time visibility of the location of their inbound and outbound material. Such visibility will increase the confidence of all parties that material will arrive at the time promised. It is also predicted that the DPMS will allow for the shifting of material in route so that the prioritized end-user is receiving the material they need to fight. Customer Wait Time (CWT) will be reduced and Time Definite Delivery (TDD) will be a reality.

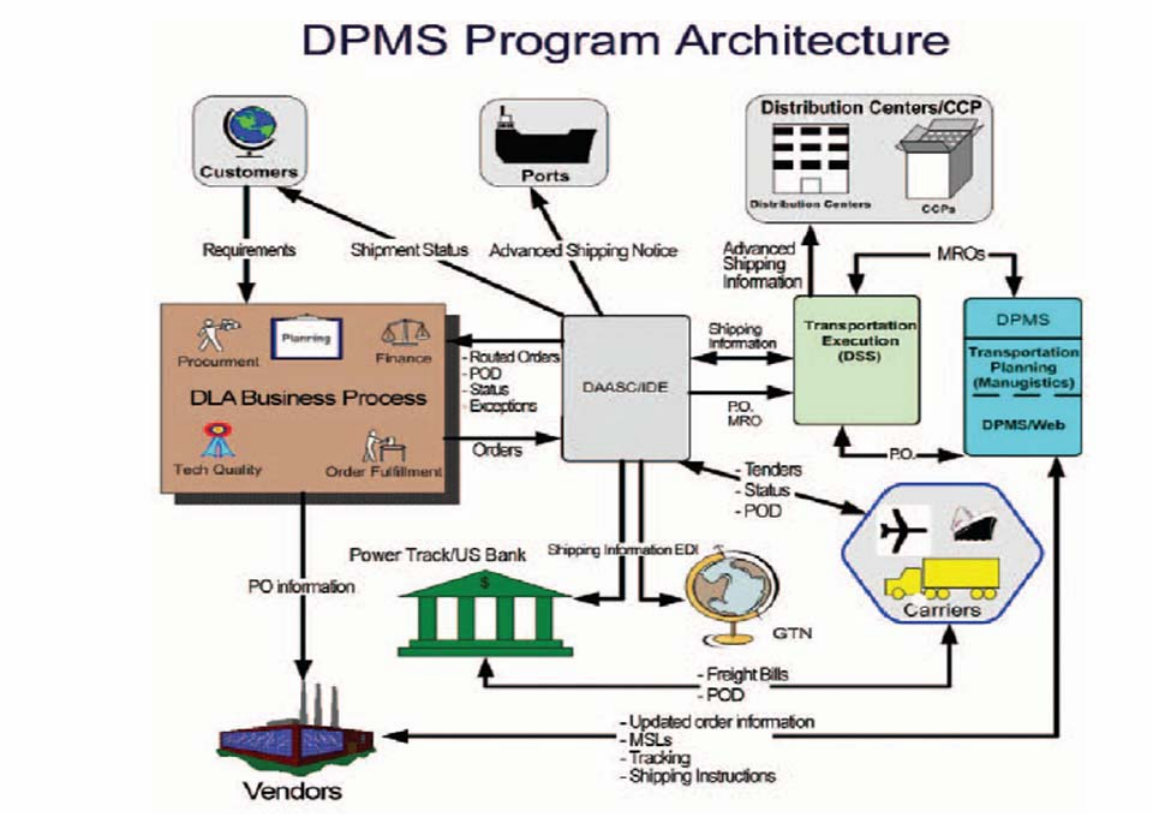

Figure 3.13. DPMS Program Architecture (From: [57])

d. Integrated Data Environment (IDE)

A centralized repository for all the of the DOD's supply chain management data is needed so that costly system-to-system data interfaces can be reduced. That is the purpose of the IDE. It will function as the authoritative source of logistics information and all of the other logistics automated information systems will access it to retrieve the information they need to support the logistics enterprise. Information such as the correct location of a unit will be maintained in the IDE so that material is delivered to the right place. IDE will eliminate the need for such information to reside in multiple systems.

e. National Inventory Management Strategy (NIMS)

In an effort to break down the barrier between the wholesale and retail levels of supply in the DOD, DLA has created the vision for NIMS. Designed to track consumable supplies from the wholesale level to the point where the item is handed off to the ultimate customer, NIMS will establish a single inventory of all consumable stock so that DLA can tailor stocks by site thereby improving customer support. No longer will the wholesale level lack visibility of what is being kept at the retail level. Historically, this lack of visibility has resulted in redundant inventories being kept at both levels because it is unknown what is where. A cornerstone of the NIMS concept is that DLA would own the inventory no matter where it is stored until it is sold off when requisitioned by an end-user.

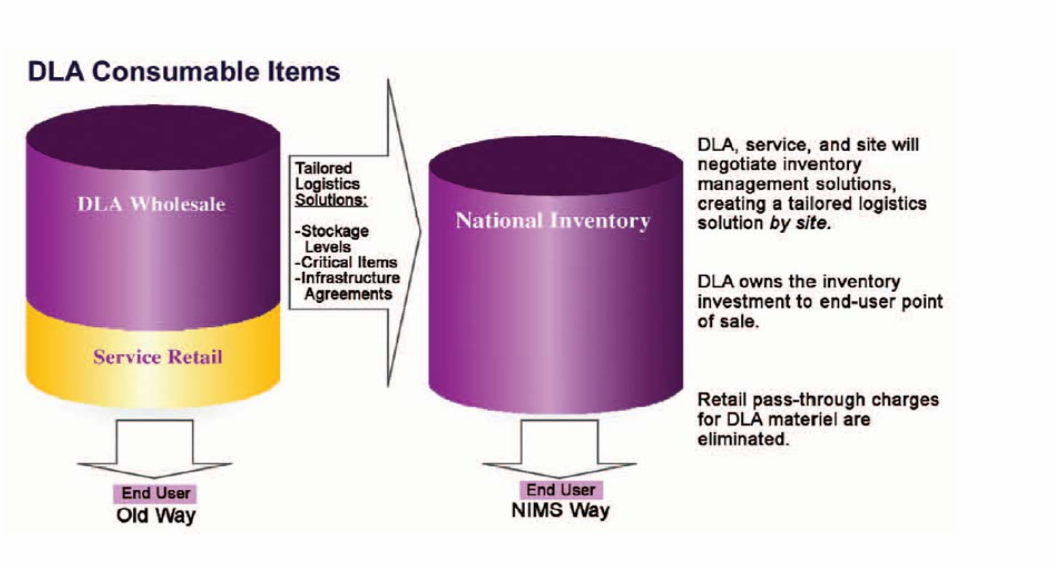

Figure 3.14. The NIMS Vision (From: [57])

f. Global Stock Positioning (GSP)

GSP is an initiative to reduce the number of distribution centers necessary to support DLA's mission. It is a consolidation effort that is being undertaken because of the reduced levels of inventory that will be carried as result of the ERP. The goal of the GSP is to maintain the inventory that is carried at the right locations so the supply system is responsive to customer demands. With the GSP, there will be an increase in the number of combined distribution centers supporting co-located customers. "By implementing the GSP, DLA is ensuring that the right inventory is at the right locations to meet warfighter requirements. The result: reduced costs, reduced customer wait times, improved warfighter readiness and a reduced logistics footprint" [57].

g. Product Data Management Initiative (PDMI)

Currently, most of the technical manuals relating to the products DLA buys are kept manually. The PDMI is aimed at automating the maintenance manuals and operating procedures for the products DLA manages. Once automated, the discontinuities of the manual documents will be eliminated and customers will have access to the most up to date technical data about an item being ordered. Programs such as the PDMI have proven successful in the commercial sector and through the reengineered business processes and COTS software, DLA hopes to have:

- a single virtual workspace for all technical users;
- a standardized, enterprise-wide business process supporting all product and product data specialists and related staff;
- a fully automated, modernized, and re-engineered set of technical business processes that will significantly contribute to and improve DLA's overall cross-function and cross-process responsiveness to its customers;
- automated management of technical and product data used in support of DLA managed items;
- technical business processes, including links to technical specifications, drawings, manuals and transaction data;
- complete visibility into all product and technical data associated with DLA items, including the ability to provide this visibility to DLA's customers in coordination with the CRM initiative;
- a reliable ability to exchange documents and forms with service design activities;
- a reliable, robust, and seamless interface with BSM's SAP application, which will enable true cross-process functional flows;
- a reliable, robust and wholly automated document management function to support both PDMI and the BSM suite of applications, including bid set and bill of material (BOM) support;
- a replacement for Joint Engineering Data Management Information and Control System (JEDMICS) based on contemporary technologies; and
- a COTS and standards based application that will provide cost-effective sustainment and enhancement capabilities.

h. Reutilization Modernization Program (RMP)

The last initiative that will work to modernize the complete life cycle of the material procured by DLA is the RMP. Created to replace the Defense Reutilization and Marketing Services (DRMS) current IT systems, the RMP is COTS software that will easily fit together with the BSM ERP. When the RMP is in place, DLA will have digital access to all the data about an item from procurement to disposal.

E. THE UNITED STATES MARINE CORPS

While the Navy, Army and DLA were getting their separate ERP programs started in the late 1990s, the Marine Corps delayed starting any projects until studies were done to analyze the problems with the Marine Corps' current logistics environment.

Named the Logistics Information Resource (Log IR) Strategic Plans, the studies concluded in 1998 that much like the other service branches, the Marine Corps was also running old, non-integrated systems that were not keeping pace with the modern logistics practices of the public sector. Specifically, the non-integrated, stovepiped processes and systems resulted in a complex logistics chain designed to support peacetime operations. In war, the processes used to support combat operations change and therefore, the Marine Corps support personnel are required to learn new processes and systems while moving with the combat forces engaged in battle.

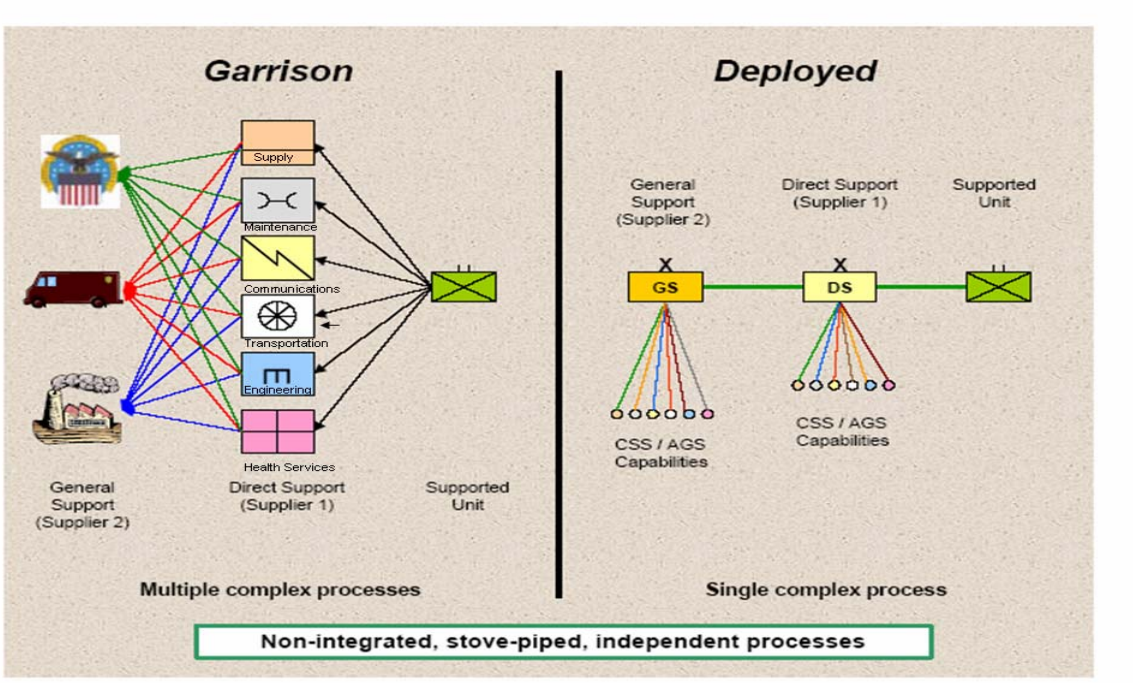

Figure 3.15. Current Logistics Chain in Garrison and Deployed (From: [61])

Additional problems with the Marine Corps' logistics chain include [61]:

- Multiple complex processes exist that must be managed at the supported unit level. Numerous specialized systems and skills are required, placing the burden on the warfighters to fulfill their own logistics needs and detracting form their fundamental core competency-to execute combat or combat support operations.
- Inadequate information visibility exists along the Marine Corps logistics chain to support informed logistics planning and execution decisions. Today supported units do not have visibility regarding status of their requests for products, and/or services, service capacity (e.g., people, equipment) available to fulfill their requests, and inventory available

within and outside the Marine Corps (e.g., Defense Logisitics Agency (DLA) and vendor inventory) to fulfill their requests.

- This lack of near real-time information sharing is leading to demand uncertainty and mountains of excess inventory (i.e., safety stock).
- Inventory is managed and positioned by class of supply and according to doctrine and policy, with very little understanding of the importance of the individual end item to mission accomplishment and the ability of the global supply environment to support the demand. This results in large amounts of redundant and layered inventory (the "Iron Mountain") being maintained along the logistics chain.
- Numerous and conflicting metrics exist, with most not aligned to Marine Corps strategic goals.

1. The Blueprint

Once the problems with the logistics environment were identified, the Marine Corps decided that a logistics operational architecture (Log OA) needed to be designed to remedy the situation. In December 2000, work on the Log OA got started and shortly after initiation, it was determined that best architecture would be one that can be used in both garrison and deployed.

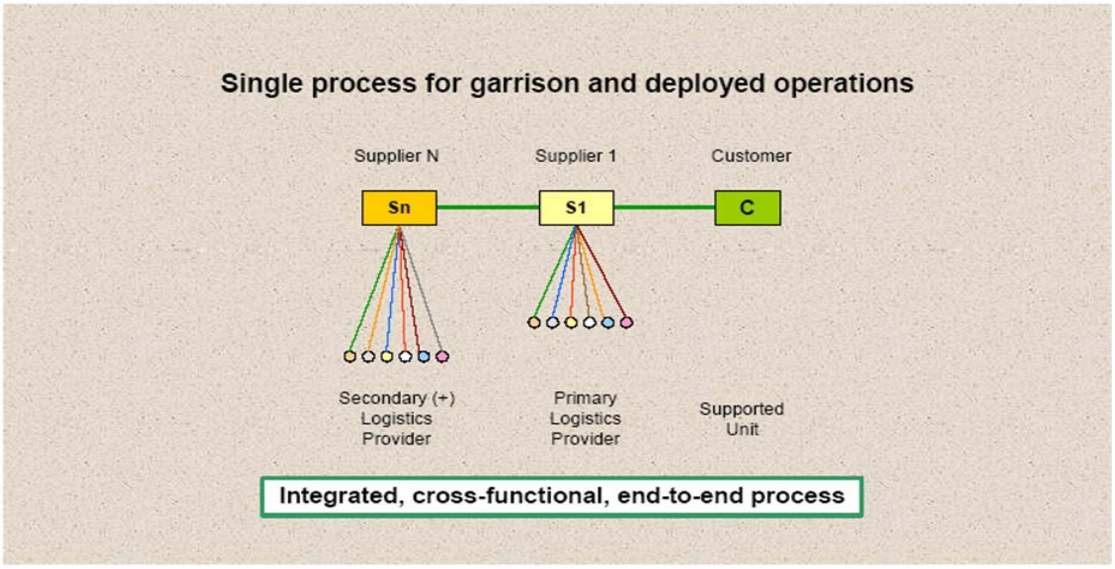

Figure 3.16. Future Logistics Chain in Garrison and Deployed (From: [61])

Thus, the resulting architecture called for a single process that could deliver material from "factory to foxhole" [61].

To complete the envisioned integrated architecture, the Marine Corps Logistics Modernization (Log Mod) program was started in late 2003 with the launching of six initiatives encompassing the different aspects of the program [61].

a. Log OA

The first initiative was an expansion of the original Log OA and was created to map out the details of a single end-to-end process for Logistics Chain Management (LCM) based upon the recommendations of the commercial sector. An expanded Log OA is the foundation for the Log Mod as a whole because it encompasses all of the actions and interfaces that must take place to fill a request. The Log OA also blueprints the communication assets and personnel structure that should be in place to implement commercial logistics best practices. Finally, the Log OA includes a plan for capacity management analysis for products, services and transportation assets as well as a plan for In-Transit Visibility (ITV) and Total Asset Visibility (TAV).

b. Log C2

To route request and provide the visibility to all the parties involved in the Log OA, an extensive telecommunications network must be planned for. The Log C2 is the initiative that was started to cover this portion of the Log Mod program.

c. CSS R/R

Historically, three active duty Force Service Support Groups (FSSGs) support all Marine Corps ground logistics for the three Marine Expeditionary Forces (MEFs). Each of the FSSGs is uniquely organized to support the different command structures. This arrangement is not consistent with the requirements of the Log OA. Therefore, the Combat Service Support Rename/Reorganize (CSS R/R) initiative was started to rename and reorganize the FSSGs to align with the Log OA. It is also expected that the CSS initiative will provide more consistency to the FSSGs in terms of size and structure because under the CSS R/R framework, the organizational structure is identical for I, II and III MEF.

d. MAGTF Distribution

The Marine Air-Ground Task Force (MAGTF) Distribution initiative was started to oversee all the aspects of physical material flow. Due to the fact that a critical requirement of the Log OA is ITV, every delivery platform in the end-to-end supply chain must be integrated to provide visibility of assets as they travel the path to and from the customer. MAGTF Distribution is responsible for making that integration happen so that all transportation assets within the MAGTF and external to the MAGTF are linked into the architecture to provide updates on material location.

e. ROM

Poor maintenance effectiveness and a lack of available operational equipment has been the result of the Marine Corps' five Echelons of Maintenance (EOMs) for ground equipment [61]. Consequently, the Realignment of Maintenance (ROM) initiative institutes the three levels of maintenance used in the air side of the MAGTF. Under the ROM, there will be an Operator/Crew level, a Field level and a Sustainment level.

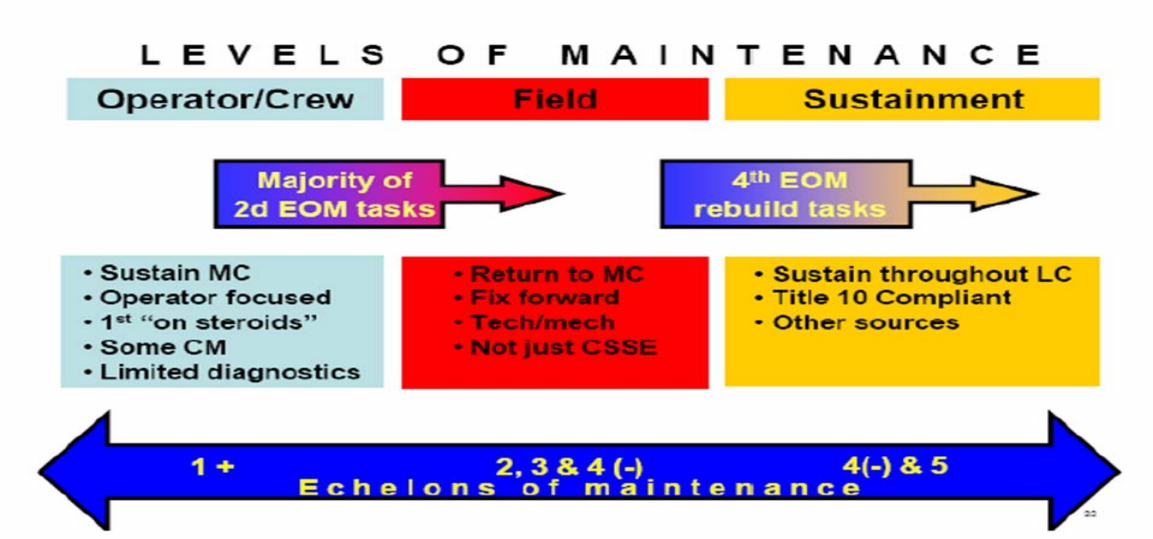

Figure 3.17. The 3 Levels of Maintenance (From: [61])

Every piece of ground equipment currently in use will be realigned to the three levels of maintenance system. Moreover, all new acquisitions of ground equipment must also adhere to the three level system.

f. ROS

Covering the inventory management aspect of the Log Mod is the Realignment of Supply (ROS) initiative. In the 1960s through the 1980s, order processing cycles took a long time. Consequently, the Marine Corps invested heavily into stocking material at the different levels of the supply chain to ensure availability of material. Managing these large inventories is cumbersome and requires a substantial outlay of funds. This problem led to the ROS so that the Marine Corps can focus on order management and move away from inventory and warehouse management. The targeted objectives for ROS are [62]:

- Remove the responsibility for request management from the supported unit to allow it to concentrate on its primary mission, implement request management [end-user function] and order management functions [supporting supply agency function].
- Centralize the responsibilities for order fulfillment and capacity management of both inventory and procurement in one supporting unit for each MAGTF.
- Manage product inventory in the logistics chain according to its criticality to the mission and its relative availability. Do not stock easy to obtain non-critical items and make heavier use of outside sources (e.g. DLA and vendor managed inventory) for these items.
- Track orders and provide in-transit visibility and total asset visibility across the logistics chain. Introduce performance management for inventory and product order management.
- Integrate ROS with related Navy, DLA and Joint programs such as Naval Logistics Integration, DLA NIMS, JEMMS, etc.
- Integrate supply with distribution according to best logistics chain management practices.
- Introduce enterprise-level inventory and inventory capacity planning to optimize the flow and minimize costs across the logistics chain.

An essential part of the ROS is the integration of the new supply chain processes with organizations external to the Marine Corps. Due to the fact that a large part of the Marine Corps ground equipment is common to the Army, the Log Mod is going to have to communicate with the Army's LMP in order to requisition material from the wholesale level for the Army/Marine Corps common operational assets. Primarily, the Log Mod is concentrating on the retail level of supply because with the ROS, it is hoping to abandon

as much inventory management and warehousing functions as possible. By relying on the Army's LMP and DLA's NIMS initiatives, there is great potential for a massive reduction of Marine Corps owned inventory. There are nearly 500,000 items unique to the Marine Corps that will have to be planned for, but the Corps will be looking for DLA and the individual vendors to manage the inventory for most of these items [61]. As was stated in the list of objectives, the Marine does not want to "…stock easy to obtain non-critical items…" All that will be carried in inventory by the Marine Corps is equipment unique to the Corps that is hard to get. Aviation material for the Marine Corps' aviation assets is not planned for in the ROS because Marine Corps aviation is funded directly by the Navy. Hence, any changes that take place with the Navy ERP that affect Naval aviation will also apply to Marine Corps aviation.

2. Processes, Technology, and People

To tackle the objectives set out in the Log Mod, a plan has been developed that includes a three prong assault including processes, technology, and people. It has been determined that these are the three things that must fundamentally change in the Marine Corps for the Log Mod to succeed.

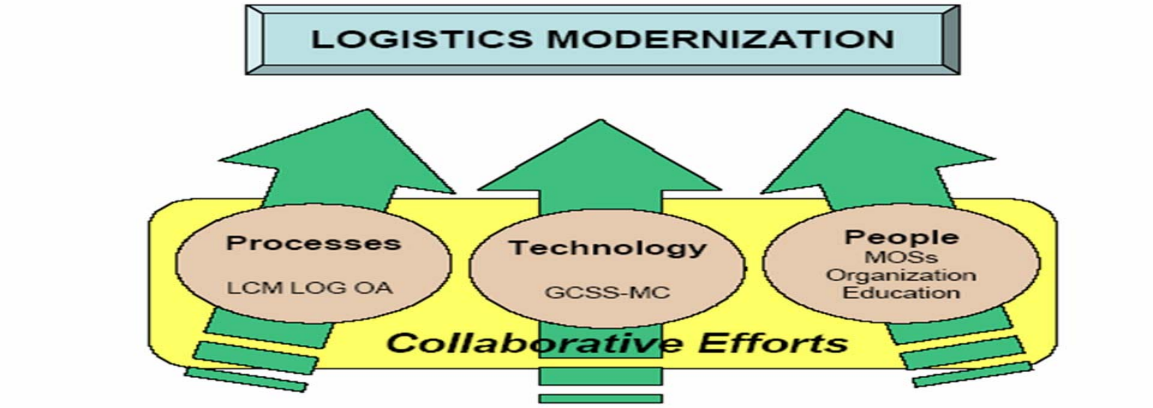

Figure 3.18. Change Elements of Log Mod (From: [61])

The Marine Corps is looking for logistics processes that "…can support any unit, in any situation, anywhere" [61]. These processes are depicted in the Log OA and provide the architectural framework for streamlining the logistics chain to support future Marine Corps operations. Changing processes must be supported with an investment in

IT. In-line with the Army's naming convention, the Marine Corps has adopted the name Global Combat Support System (GCSS) as the name for the portfolio of COTS systems that will be implemented to replace the current logistics systems. Given that the Marine Corps GCSS and the Army's GCSS are both focused on the retail piece, the name is fitting. GCSS-MC is the official name of the Marine Corps system so that it is distinguishable from the Army's. Finally, since the new processes and systems must be run by people, the personnel structure and training in the Marine Corps must change so that it fits with the new processes and technology. Moreover, the Marine Corps Log Mod team recognizes change management must be incorporated into the program so that it can overcome the resistance that will occur as a result of the implementation of new business processes. The change management plan is covered in the people portion of the overall strategy.

3. The Timeline

An incremental timeline has been instituted with the Log Mod being completed in blocks so that it aligns with the Program Objective Memorandum (POM) financial practice that is used in the U.S. Government.

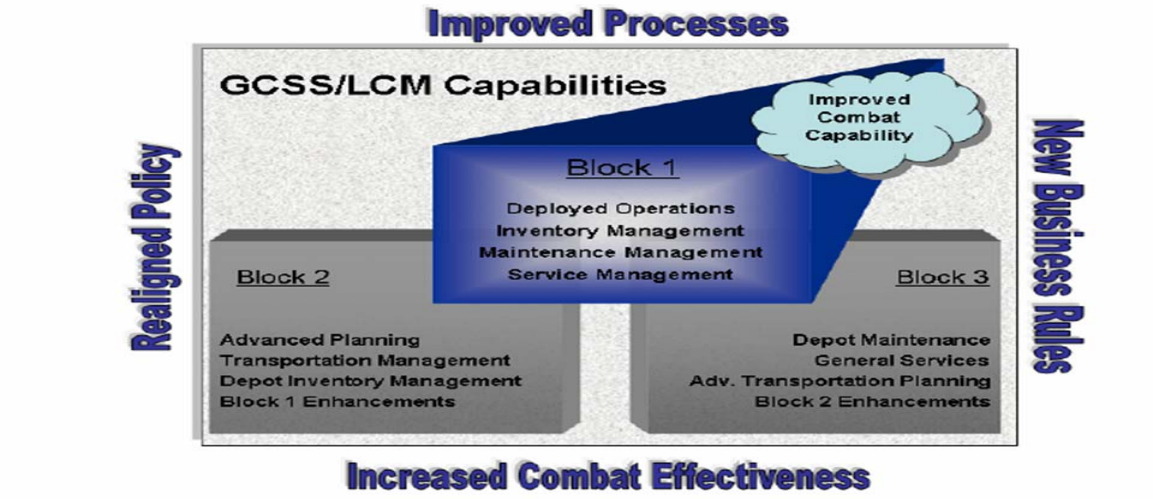

Figure 3.19. GCSS-MC Capabilities (From: [61])

Block one of GCSS-MC provides the initial capability of the system and includes such things as the functionality to support deployed operations, inventory management,

maintenance management, and service management. Within block one, the following legacy systems are to be retired: Supported Activities Supply System (SASSY), Marine Corps Integrated Maintenance Management System (MIMMS), PC MIMMS, and Asset Tracking, Logistics, and Supply System (ATLASS I) [62]. The operational requirements document for GCSS-MC was completed in late 2003 and it was established as a program of record to receive funding in the Fiscal Year 2004 POM [63]. All remaining requirements to get block one completely funded were completed in June 2006 and the program is fully funded in the 2008 POM. Currently, the Marine Corps is working the requirements for block two with a scheduled completion date of June 2008 so that it can be funded in POM 10. Between July 2008 and June 2010 block three will be outlined for funding in POM 12. Full operational capability (FOC) of the Log Mod system as a whole is anticipated by 2015.

Officially, it can be said that the Log Mod got underway in 2003 when GCSS-MC was established as an ACAT I program of record. This categorization put the Log Mod on an equal footing with the expeditionary fighting vehicle. Once established as a program of record, the Commandant of the Marine Corps put his endorsement on the program in January 2004 when he released a Marine administrative message, a personal-for message, and an all Marine Message (ALMAR) that emphasized the fact that the Marine Corps "…cannot improve the combat capability of the MAGTF without this LOGMOD" [63]. This message caused an increase in momentum on the part of his staff and in July 2004, the Deputy Commandant, Installations and Logistics launched the Log Mod Transition Task Force (TTF). After developing the six Log Mod initiatives (Log OA, Log C2, CSS R/R, MAGTF Distribution, ROM, and ROS), the TTF briefed the Expeditionary Force Development System (EFDS) Working Group who in turn formed an Assessment Group to write the directives to begin implementation.

With the initiatives in place and the requirements detailed, it was time to select a software vendor. Unlike the Army, Navy, and DLA, the Marine Corps selected the Oracle e-business suite as their ERP of choice for the Log Mod in August 2004. It has been stated by the Program Manager for GCSS-MC that Oracle was chosen "… because it satisfied the functional requirements more completely, provided greater flexibility for future needs, and demonstrated an understanding of the challenges" [63]. Shortly after

making the decision on the software, the hunt began for an integrator. The Marine Corps turned to Office of the Secretary of Defense (OSD) enterprise software initiative (ESI) in order to shorten the timeframe for acquiring an integrator. It was estimated that using the ESI save ninety days on the selection process. The integrator search began in November 2004 and by April 2005 Accenture had been chosen to help make the Log Mod a reality. Progress has been steady since the GCSS-MC team was formed with Oracle and Accenture and initial operating capability (IOC) for block one is expected in the Fall of 2008. For Fiscal Years 2003 through 2007, the total cost for GCSS-MC is $171.7 million [64], [65].

F. THE UNITED STATES AIR FORCE

Being the technologically savvy branch that it is, it is somewhat surprising that the Air Force hesitated with their ERP program until post Y2K. Like the other services, the Air Force also recognized in the late 1990s that the seven hundred plus legacy systems in the organization's combat support IT portfolio were not capable of adequately tracking personnel and critical supplies. The ten detailed weaknesses of the legacy systems that the Air Force identified during that time period include [66]:

- Lack of Authoritative Shared Data.
- Lack of Easy Global Access.
- High Operations and Maintenance Cost.
- No Common User Interface (UI).
- Insufficient Interoperability.
- Hardware Dependency.
- Insufficient Network Access.
- Limited Decision Support Tools.
- Excessive Functional Dependency.
- [Insufficient] Visibility.

However, instead of immediately starting a project as was done in the Navy and Army, the Air Force followed the Marine Corps methodology and devoted themselves to defining the requirements and documenting the architecture to achieve the requirements.

1. GCSS-AF

In December 2001, the Air Force Material Command published the Operational Requirements Document for the Global Combat Support System – Air Force (GCSS-AF). The vision for GCSS-AF is a family of systems that has the ability to combine the information of the 23 combat support functional areas into an integrated environment to provide trusted data to all users. A portion of the GCSS-AF plan includes linking external entities such as the National Command Authority, the other service branches and allied and coalition partners to the integrated data to present a common operational picture to support joint operations. This vision is diagramed in Figure 3.20.

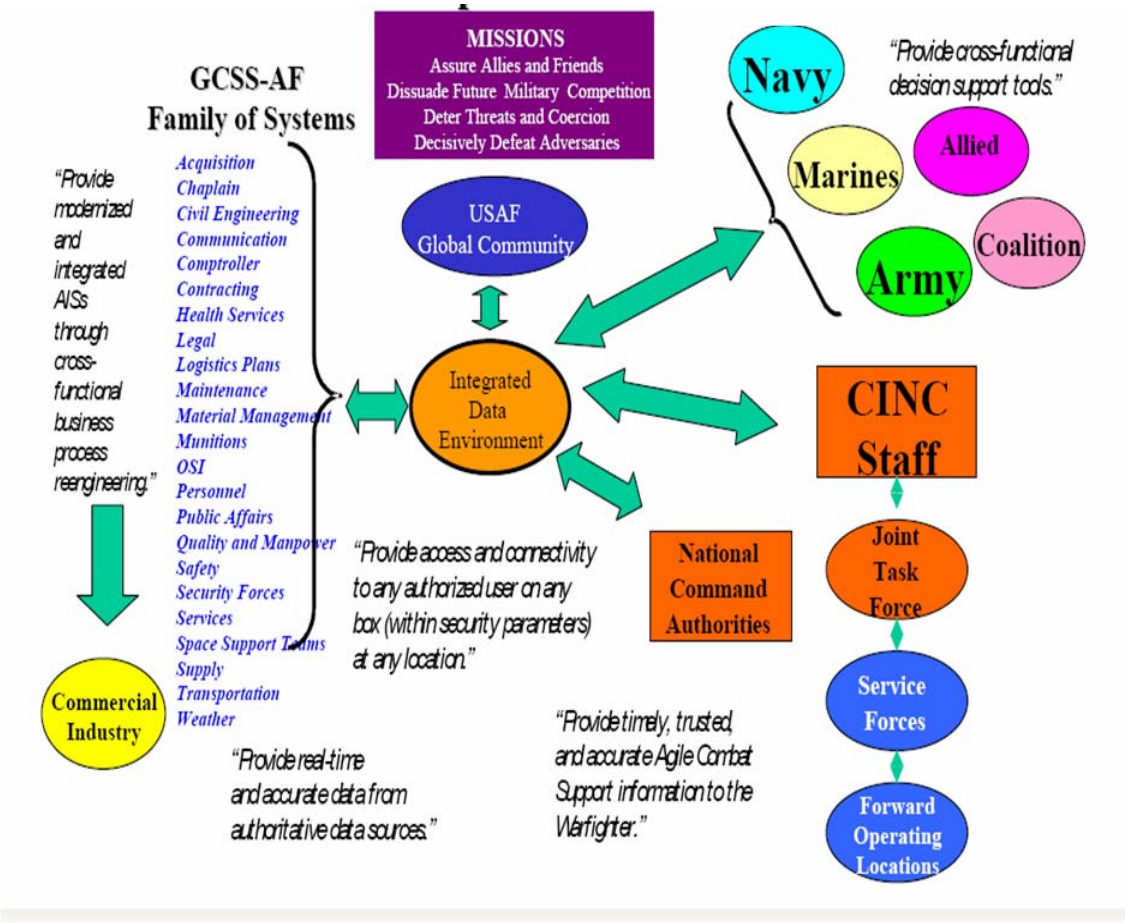

Figure 3.20. GCSS-AF High-Level Operational Concept Diagram (From: [66])

2. ECSS

From the overarching framework of the GCSS, the Air Force subdivided out the logistics portion of the enterprise and titled it the Expeditionary Combat Support System

(ECSS). An exhaustive explanation of the ECSS system is not necessary because it copies the Marine Corps' GCSS-MC program with the only difference being that it includes the wholesale level of supply. As was done by the Marine Corps, the Air Force formed an architecture for the ECSS which they titled the Logistics Enterprise Architecture (LogEA) [67]. Also like the Marine Corps, the Air Force selected the Oracle e-business suite as their ERP of choice for the ECSS and signed an $88.5 million, multiyear contract with Oracle on October 25, 2005 [68]. Almost a year after awarding the ERP contract to Oracle, the Air Force broke out of the Marine Corps mold when they awarded a $627.8 million, multiyear contract on September 7, 2006 to the Computer Sciences Corporation (CSC) for integration services [69]. The ECSS is expected to be fully operational by September 2013 [70].

IV. PROGRAM COMPARISON

A. JOINT VISION 2020

Released in June of 2000, Joint Vision 2020 is the document that the DOD is currently using to guide the future of America's Armed Forces. The document builds and expands upon the principles established in Joint Vision 2010 to emphasize the changes that took place in the global environment between 1997 and 2000. However, the overarching strategy of full spectrum dominance first revealed in Joint Vision 2010 is carried forward in Joint Vision 2020 and it remains the goal for the DOD to work towards to meet and defeat its adversaries in the future. Along with full spectrum dominance, the foundational pillars of dominant maneuver, precision engagement, full dimensional protection and most important for the DOD's ERP programs, focused logistics are carried forward in Joint Vision 2020 [71].

B. SEA POWER 21

To incorporate the Navy's capabilities into Joint Vision 2020, the Chief of Naval Operations published Sea Power 21 in October 2002.

Figure 4.1. Sea Power 21 (From: [72])

Sea Power 21 is the name of the Navy's strategic vision for how it will organize, integrate, and transform in the coming years to meet the requirements of Joint Vision 2020. Like, Joint Vision 2020, Sea Power 21 is made up of foundational pillars that work together to achieve the Navy's overarching strategy and correspond to the pillars of Joint Vision 2020. In Sea Power 21, the foundational pillars are Sea Shield, Sea Strike and Sea Basing. Sea Shield is the Navy's version of full dimensional protection and Sea Strike covers dominant maneuver and precision engagement.

1. Sea Basing

Sea Basing ties in with focused logistics and is important because the objective of the pillar is to place at sea, a network of platforms that include strike ships (aircraft carriers, frigates, destroyers, etc.), combat logistics force ships, and maritime prepositioning ships that are operated by the Military Sealift Command. Modern technology that facilitates the networking of these different platforms with communication systems and sensors is overcoming the traditional view that forces at sea have a difficult time with interoperability due to dispersion. Rather, the netted force of ships can be viewed as an operating platform from which the joint and coalition commander can employ "…offensive and defensive firepower, maneuver forces, command and control, and logistics" [73].

There are several reasons the Navy has placed Sea Basing as an integral part of the Sea Power 21 vision. The first reason is that with bases at sea, there is a force available to rapidly respond to crises and project power throughout the world. Secondly, a reduced footprint ashore can be achieved by leaving the command and control (C2) and logistics assets aboard ship. The third reason is it has been getting increasingly difficult for the U.S. forces to operate from foreign soil. Recent examples of this dilemma include the trouble the U.S. had with Turkey in Operation Iraqi Freedom and the withdrawal of the American military presence form Saudi Arabia. Therefore, by deploying forces from the sea, the U.S. can avoid the political and military obstacles that might obstruct the establishment of land bases. Lastly, and most importantly, as a concept, Sea Basing requires a substantial Navy. Thus, it provides the Navy ammunition in the fight for the precious tax dollars that all the services are desperately vying for.

2. Joint Logistics

To effectively compete for these tax dollars in the post Goldwater-Nichols military, a demonstration of how a capability is applicable in the joint arena has become paramount. Consequently, the Navy has looked outside of itself, and incorporated the Air Force, Army and the Marine Corps into Sea Basing. For the Air Force, Sea Basing envisions "… Air Force unmanned combat vehicles surging to sea bases rather than bedding down ashore" [73]. The integration of the Army and Marine Corps is more extensive. It is proposed that the Sea Bases can serve as assembly areas where the Army and Marine units deploying into a combat theater can be married up with the larger weapons systems that are carried by sea. Upon the arrival of the soldiers and Marines on ship, the weapons systems can be selectively retrieved and assembled prior to embarking the troops off the ship and into combat. Not only are the Sea Bases important to the Army and Marine Corps for retrieval of equipment, it is also anticipated that they will be the source for the critical sustainability packages of supplies the ground forces require as they conduct combat operations. Historically, the Navy has always filled this role for the Marine Corps but Sea Basing emphasizes the importance of this capability to reduce the Marine Corps footprint ashore. The added idea of having ships operate as assembly areas for Army soldiers is what makes Sea Basing a departure from traditional operational doctrine [74].

The technology that will make the Sea Bases capable of meeting the requirement for an assembly area and supply point is twofold. First, the ships must have the latest advances in inventory management and automated material handling systems so that they can locate, identify and retrieve the necessary equipment while remaining at sea. Second, the Navy and its ships has to have a logistics system that incorporates modern supply chain management initiatives like "Just In Time" supply, Total Asset Visibility (TAV) and In-Transit Visibility (ITV) as well as be integrated with the Air Force's, Army's, and Marine Corps' logistic systems so that it can make the vision of Sea Basing a reality [74].

C. TROUBLED APPROACH

The U.S. National Command Authority (NCA), the separate service component Secretaries and Joint Chiefs of Staff are trusting that the integration of the separate DOD

ERPs at some point in the future will deliver the warfighting support potential resident in the strategic documents of Joint Vision 2020 and Sea Power 21. Unfortunately, this is the only thing that can be hoped for because of the separate approaches that were taken toward ERP when the projects first got started in the late 1990s. During this period, the DOD should have established a central ERP office and the DOD in its entirety could have been defined as the enterprise to be covered by a single ERP.

1. Ideal ERP

Theoretically, one ERP for the entire DOD ought to be possible because the separate services logistically function in the same way. For example, each branch of the military has aircraft. All aircraft require parts and maintenance. The ideal situation would be one ERP controlling the processes for the supply of parts and maintenance on aircraft across all the services. This would allow service members with similar functional backgrounds to work side by side in the joint operational arena without any concern for knowledge barriers resulting from disparate process comprehension. Facilitating an environment where Air Force supply clerks could order parts for Army helicopters. Marine jet mechanics could work on Air force jets and so forth. Instead, the best outcome is the separate ERPs can be connected at some point in the future to provide an integrated view of the entire DOD's data. While not perfect, the envisioned solution is a drastic improvement over the current operating environment which has soldiers, sailors, airmen and Marines using unique logistics systems with no integration. The severe problem with this environment surfaced recently in Operation Iraqi Freedom where "…platoons were unable to locate the nearest MRE's (Meals Ready to Eat), spare parts were difficult to obtain driving multiple re-orders and unidentified supplies were stockpiled at significant cost without contributing to warfighter effectiveness" [5].

The first-class corporations that have successfully transformed their organizations using ERPs are those that identified their common core business functions and aligned their ERP around those functions to maximize their potential. Notionally, this should have been possible within the DOD. The entire DOD has common characteristics which include personnel, equipment, and facilities. Each one of these characteristics has common data points as well. For example, all personnel have a social security number,

age, gender, rank, etc. All equipment has a dimension, part number, national stock number, name, etc. Facilities have an equal number of common characteristics. The core business function of the DOD involves leaving the facilities and transporting the personnel and equipment around the world to engage foreign adversaries. In this endeavor, there are common transportation platforms as well as a universal support structure that supplies the military both at home and abroad with the primary example being DLA. The similarities between the service components do not end at their business functions. A review of the reasons discussed in Chapter III for each of the services' and DLA's choice to initiate an ERP project reveals that collectively they are facing the same problem: outdated business procedures and processes running on antiquated software systems.

By focusing on their commonality vice their differences, the multiple sectors that form an entire organization can achieve what is known as conceptual unity. The proof that conceptual unity can be achieved by any organization no matter how large is demonstrated by the nation of Singapore. Studies of the country have shown that "…Singaporeans as a whole understood the vision and mission of Singapore" [5]. The embracing of conceptual unity between the government and industry has led to the label "Singapore Inc" [5]. Disappointingly, because the DOD CIO that was appointed as a result of the Information Technology Management Reform Act (ITMRA) did not push conceptual unity at the outset of the ERP undertakings and because the funding for the ERP acquisitions resides at the service level, the services are left working toward the same objective in different ways.

2. Adopt Proven Methodologies

In industry, it has been proven that integrating ERPs of separate organizations is a much easier task than integrating legacy stovepiped systems. This fact is evidenced by the trend of companies migrating from ERP to ERP II that was discussed in Chapter II. While, it is not ideal that the separate service components and DLA are working on their ERP projects individually, it is the reality of the situation. Thus, the best that can be hoped for is the successful implementation of the current projects and the future integration of these projects. The numerous examples from industry (also in Chapter II)

where ERP integration has been a proven recipe for success are the reason for the trust that the DOD has placed in the future interoperability of the separate ERPs. However, to attain the vision of an ERP enabled and integrated logistics environment, the service components are going to have to abandon certain practices common to the military and embrace the successful ERP methodologies verified in industry while avoiding the ERP pitfalls.

3. Past Mistakes

Chapter II presented pilot projects as a beneficial way of testing the organizational redesign that an ERP entails prior to translating the redesign across the entire organization. It is a risk reducing approach because a pilot proposes easy termination if it is determined that the project is not going to meet expectations. For an organization that is adverse to risk like the U.S. Navy, this seemed like the perfect route to success when they started the four ERP pilot projects in 1998. However, the initial framework that the Navy set their pilot programs up in steered the project toward trouble from the start.

Technochange experts recommend that only one or two pilot projects be initiated [33]. The first major mistake of the Navy was to go against this recommended number of pilots. Instead of one or two, the Navy started the four pilots outlined in Chapter III. Each of the pilots was independently headed by the Commanders of the separate SYSCOMS and no manager was put in place to oversee the projects as one initiative. The choice to not establish a single point of contact to supervise the Navy's ERP program does not follow the principles for transitioning to an ERP that have been set by industry and technochange guidance which advocates that a "strong man" has to be part of the effort. While the Commanders of the separate SYSCOMS are high ranking naval officers, when comparing the Navy to a corporation, they do not equate to the Chief Operating Officer and can thus be considered middle management. Furthermore, the spreading of responsibility for a high risk project amongst several leaders is a common practice of the Navy headship. The purpose of the practice is to avoid a single agency head being identified or held accountable for cost overruns or a project's failure. It is evidenced by the manner in which the Navy handles its shipbuilding budget. The current headlines state that multiple shipbuilding programs have repeatedly busted their budget

and the "…House Armed Services Committee wants to know who to blame" [75]. This desire by Congress to find someone to be responsible for the shipbuilding program has led to an amendment to the 2007 Defense Authorization Act that requires the Navy "top brass" to take responsibility for it.

Unfortunately for the Navy ERP program, there was no such amendment looking out for its best interest back in 1998 and the four pilots began with no overarching structure to resolve differences and steer the project in a unified direction. In technochange and transformational change efforts, a "strong man" that exhibits strong leadership is critical for success. The literature surrounding both types of change states that solid leadership is an indispensable element that must be present to move the change process forward. Without "… new leader[s], great leader[s], or change champions" it is highly probable that the intended transformation will fail [76]. Continuity of these change champions is also an essential element to see the change through to completion. The type of transformational change that an ERP brings about takes time. Military officers in key positions to influence major change only stay in those positions for two to four years. This rotation schedule can kill the momentum of an ERP project if the follow-on leader does not place the same amount of emphasis on the program that the previous leader did.

The Navy ERP pilots did not have a "strong man" and it took a heavy toll on the program because the functional overlap between the pilots was ignored by the management teams [77]. The overlap is a result of the fact that the SYSCOMS have a tremendous amount of commonality and their leadership refused to acknowledge this fact. For example, as was stated previously, military equipment has common characteristics such as national stock number, part number and nomenclature. All the pilots dealt with military equipment in some form or other and the individual pilot leadership chose to ignore this commonality vice embrace it. "Instead, the Commanders of the SYSCOMS and the project managers directing the projects evolved the pilots into programs and shifted the emphasis from a trial to a project which was to be completed and implemented. A competition ensued over which command could get their ERP up and running first. To remain on schedule, inter-project cooperation was discouraged which led to a lack of formalization on the format of common data and processes that

should be followed in the accomplishment of tasks" [77]. Without an overarching leadership structure to manage the pilots, there was no way to force cooperation and the pilots drifted further and further apart in their approaches.

The Navy contends that four pilots were started because it was believed that doing one implementation for all the SYSCOMS was too large of an undertaking to be successful and rationalized the pilots by asserting that they were designed solely to test the functionality of an ERP within the Navy [77]. Having multiple pilots was a way to reduce the risk and gave each of the pilots a better chance for success. It is true that pilots are a good way to reduce risk because they provide users "hands-on" experience with the new processes and allow for feedback on where improvements need to be made before the pilot is expanded to other parts of the enterprise. However, it can be contended based upon the way the Navy handled the shipbuilding prior to 2007, that four pilots were started because it provided for a spread of responsibility in the event that someone was going to be held liable for cost overruns or failure. Had only a single pilot been started at one of the SYSCOMS, it would have demonstrated how the selected ERP (SAP R/3 in the case of the Navy's pilot programs) would handle the common data and processes of all the SYSCOMS. Better yet, all the SYSCOMS could have sent representatives to work on a single pilot to negotiate the proper format for the common data and processes.

In industry, a conglomeration of representatives from the different functional areas that come together and are responsible for configuring an ERP are known as a core team. A solid core team that has both business and technical knowledge has proven to be a vital factor to successfully configure an ERP [78]. Then again, this arrangement would have required a single high ranking representative from the Navy to hear out the separate arguments within the core team and make determinations in the best interest of the Navy as a whole. Regrettably, all of the senior Navy personnel and project managers were unwilling to leave their roles as managers to take on a role as a leader. There is a difference between a manager and a leader because "management's mandate is to minimize risk and to keep the current system operating. Change, by definition, requires creating a new system, which in turn always demands leadership" [76]. Furthermore, it is probable that if only one pilot had been started instead of four and it was ruled a failure or

had some cost overruns, nobody would have been held accountable because that is the purpose of pilots. They are by their very nature tests of whether a proposed solution is viable or not. The ingrained protectionist attitude and competition between peers exhibited by the pilot's management teams led to a pilot structure that prevented any possibility for success and deplorably wasted a huge sum of taxpayer's money in doing so. "Problems with the structure and the commonality of the pilots was addressed with the program managers but it was judged to be mutinous commentary" [77].

The decision to use multiple pilots instead of a single pilot was a big mistake but it was not the only mistake made in the early stages of the Navy ERP. Using a prototyping approach also proved to be a hazard to the project because the user involvement led to an attempt to align the prototype with the old business processes which is ERP pitfall number one: overcustomization. Private companies that had core teams who made attempts at layering their old business processes within the mold of an ERP discovered it is a fruitless job. Legacy systems allowed for process customization because they were coded according to the processes of individual industries. The processes were in existence before the legacy system came about and the legacy system came into being as an automation tool for those processes. This is fundamentally different than an ERP which is a template that has certain structural elements that should not be changed. Those elements exist to help organizations implement standard business processes across the spectrum of operational divisions. The templates also make it impossible to avoid a revision of processes during implementation. If the users who are involved in the prototype are reluctant to re-engineer business processes to conform to the ERP, the implementation of the ERP runs a high risk of failure [79].

All of the service components within the DOD can be defined as mechanistic organizations. "The ideal model of the mechanistic organization is one of efficiency and predictability, hierarchically ordered, in which planning and decisions occur at the strategic apex and are implemented at lower levels" [80]. A hallmark of such an organization is a culture that resists change. In essence, the service members who are in the Navy are the Navy and undeniably part of the culture. The ideal model is an exact description of the best way to bring about change in a mechanistic organization. Drive it from the top. If members of a mechanistic organization are not forced to change by the

leadership, they will naturally resist it because of the culture. The level of commitment the Navy leadership extended toward the ERP pilots has already been addressed. Given the context, when asked to make concessions to the ERP's way of doing business, the users guiding the prototypes in the pilot programs said no and there was nobody there to make them change their minds [77]. Of course, implementing an ERP which has been designed to operate in the corporate world where money does not expire at the end of the fiscal year or have numerous policies dictating how it is spent does have its inherent challenges. Also, the ERPs of the late 1990s were not as flexible and did not support the open architecture standard that they do today. Nonetheless, it was not these challenges in their entirety that led to the weaknesses of the Navy's pilots. Could it be argued that they were a contributor? Definitely! Yet, a larger contributor to the shortcomings of the pilots was the inability of the users to change and a lack of commitment by the leadership to the proposed change [77].

At the conclusion of the pilots, the U.S. Government Accountability Office (GAO) categorically ruled the pilots a failure. They declared that what had been created was "…four more DOD stovepiped systems [systems incapable of interoperability that serve a single function] that did not enhance the DOD's overall efficiency and resulted in $1 billion being largely wasted" [45]. The Office of the Under Secretary of Defense for Acquisition Technology and Logistics defended the pilots arguing that "The Department views the pilots as successful, exceeding initial expectations, and forming the foundation upon which to build a Navy Enterprise solution" [45]. As presented in Chapter III, the Navy is currently working on the integration of the work completed on the pilots to create a converged ERP solution. The GAO contends that by creating a converged solution, the Navy is essentially starting their ERP over [45]. To implement the Navy's converged ERP, the GAO also contends that is going to take another $800 million and it will not be operational until 2011 [45].

4. New Plan

In 2004, the Navy published an integration white paper that outlines the architecture for the converged solution [47]. The information contained within that paper highlights the problems the Navy created for itself by using multiple pilots. It states, "If

the Navy were implementing with no existing ERP solutions, the implementation strategy would be different, but the existing projects demanded careful architectural planning in order to minimize re-work and reduce risk to the fleet" [47]. It further states, "The Navy initiated multiple pilot projects in 2000, and the pilot projects were successful, but they provided localized solutions as opposed to an integrated solution for the Navy's operating forces (i.e. the fleet)" [47]. Lastly, it states, "Adoption of common business processes across maritime and aviation, which requires re-work in one or both solutions" [47]. This sentence emphasizes the fact that by having separate processes for the same tasks, the Navy's ERP is going to have to be re-worked. All of these sentences are in a document produced by a contractor working for the Navy and they still can not evade the truth that by using multiple pilots with no long term planning and cooperation to integrate the pilots, a problem resulted and a lot of money and work is going to have to go into fixing it.

It is clear from the GAO report on the Navy's pilots [45] and from the Navy's own documents that the way the pilots were structured created problems. The questions that surfaces from the debate between the GAO and Navy are:

- How much did the pilots actually cost?
- What functionality will the converged ERP deliver?
- When will it be complete?

In the case of this debate, it is clear that the two organizations are taking very different positions and the real answers to these questions most likely lie somewhere in the middle. Therefore, the DOD's Business Transformation Agency (BTA) was consulted to provide and independent third party analysis on the issues. The GAO stated that the pilots cost $1 billion [45]. Contrarily, the Navy says that "35% or 350M of the $1B referred to in the draft was for investment in the development of the pilots, while 55% was for operating and support expenses, and the remaining 10% for the early definition of the converged Navy ERP solution" [45]. For the period through Fiscal Year 2006, the BTA is advertising that the Navy ERP cost $859.7 million [81]. This figure supports the argument that to date, the Navy has spent close to a $1 billion on the ERP including the pilots. The BTA further supports the GAO's prediction that through 2011 the Navy ERP will cost another $800 million. Including the Fiscal Years 2007, 2008, and

2009, the BTA has a figure of $683.1 million. Carrying the trend out two more years to 2011 validates the GAOs claim that the cost will be somewhere near $800 million.

Functionally, the converged system that is in development is similar the Army's Logistics Modernization Program (LMP). When the convergence is complete the Navy will have an ERP to cover the wholesale level of supply.

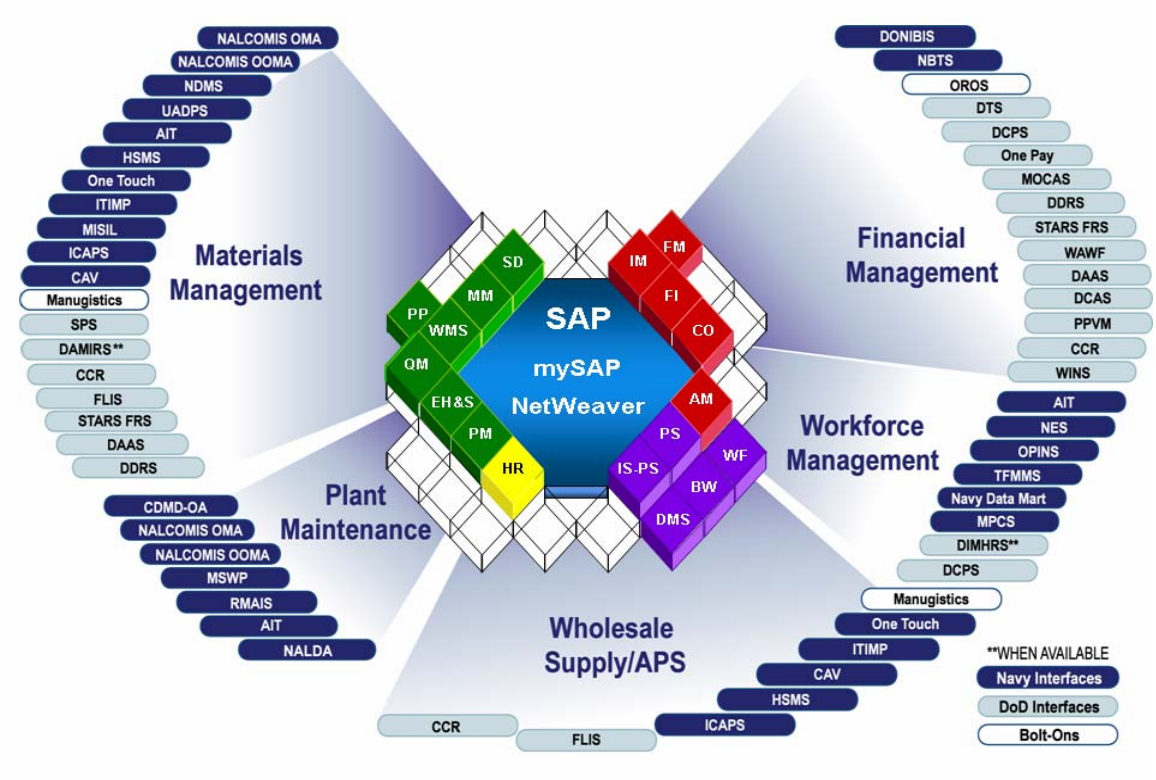

Figure 4.2. Navy ERP Interfaces (From: [4])

For the retail portion, the current plan calls for the legacy systems (UADPS, NALCOMIS OOMA, CAV, One Touch, etc.) to remain in place and be interfaced to the ERP. This relationship is depicted in the materials management portion of Figure 4.2. The ERP "deployment sites include fleet maritime and aviation intermediate-level maintenance activities ashore and major Navy systems commands and their associated warfare centers and field activities" [82]. In the integration white paper, there is a mention that "The Navy plans to deploy SAP on its warfighting vessels" which can be considered the retail level for the seagoing service. However, there is no formal program in place like GCSS-Army or GCSS-MC. For the time being, the focus is integration of legacy retail systems into the wholesale ERP.

The timeline of 2011 established by the GAO is vague so the BTA was referenced to confirm what the actual timeline is for the Navy ERP. Based upon what is being publicized by the BTA, the Navy ERP will reach full operational capability (FOC) in the Spring of 2013 [81].

D. A DIFFERENT TACTIC

Since the Navy ERP is functionally similar to the Army LMP and both programs got underway in the late 1990s using the same SAP solution, it is important to analyze the reasoning behind the different approaches. The method the Army chose for their technochange was riskier than the Navy's because they did not elect to go with a pilot or prototype. Instead, the Army selected the "…traditional design first then implement approach" [33]. This approach is preferred by the companies implementing an ERP because it is much less time consuming than the prototyping approach [33]. It is riskier because the expected results of the ERP customer are not often achieved and the organizational problems with the software that stem from the lack of user involvement are numerous. This reality was thoroughly documented in Chapter II. Nonetheless, the Army was willing to take this risk primarily because it was the recommended path to follow by their integrator (CSC). Integrators of ERPs recommend the design then implement approach to corporations because a speedier approach equates to a less costly venture. In the corporate world, the bottom line is the top priority and companies are not very receptive to lengthy change proposals that can quickly compound cost and run a high risk of failure.

1. Organizational Distinction

A speedier approach was attractive to the Army for several reasons. First, the Army did not have multiple organizations like the Navy responsible for the procurement of supplies. Unlike the Navy's aviation and a maritime branch, the Army has a single organization (the Army Material Command) responsible for its supply chain. Secondly, the Army liked the speedy approach because it is capable of overcoming several kinds of resistance. The AMC leadership recognized its role as a mechanistic organization and understood that the resistance to the ERP would be high. They also recognized their

extensive power over the organization and were willing to use it. Wielding power to force people to accept change is known as explicit coercion. It can be a very powerful tool to use in mechanistic organizations where change is never popular. The downside of using explicit change tactics is that they can potentially leave the users at the lower levels disgruntled with the change initiators [83]. If explicit coercion is going to be used, it has to be used quickly in order to defeat the resistance that is common in the BPR Organizational Life Cycle of Chapter II.

The third reason the Army elected to take the riskier approach was because their dissatisfaction with their legacy logistics operating environment was much higher than the Navy's. In change theory, there is a formula which states: "Amount of Change = (Dissatisfaction X Model X Process) > Cost of Change" [84]. A summary of the formula is that the dissatisfaction of the influential leaders with the status quo must reach a level that the leaders decide that there is no choice but to change. This dissatisfaction along with a model of the future state of the organization and the process for how the organization will achieve that end state can generate enough power to outweigh the cost of making a change. The level this power needs to reach is exceptionally high because the cost of change, which is measured by resistance to change, is significant. For the Army, the dissatisfaction with their logistics processes was at an all time high in the mid 1990s following the end of the first Gulf War. In that engagement, the Army feared that they wouldn't have the supplies they needed so they sent everything into theater and created the "iron mountains" of unused equipment discussed in Chapter I. It was reported that of the 42,000 containers that were sent overseas in support of the operation, the Army had to open 28,000 of them just to verify their contents [85]. Despite the proliferation of supplies, the Army had a remarkably hard time getting equipment to the units that needed it, when they needed it and where they needed it. This struggle was so profound that it led to a dissatisfaction level that made the Army more willing to take a riskier approach to their technochange. Contrarily, the Navy did not have the same experience in the first Gulf War because the Navy continually operates as a forward deployed force in peacetime and in war. When the ships (retail supply level) pull out of their homeports, all the supplies they need are onboard or they will be replenished while underway. For the Navy, a war in the Gulf simply meant it had to change the position of

the majority of its ships and concentrate them in one area. It need not worry about trying to make a logistics system that was designed to support home based forces function across the globe. The Army did and experienced a large amount of pain in doing so. For that reason, they were more receptive than the Navy to the advice of their integrator to make their first priority in their ERP the reengineering of their business processes [3].

Lastly, the Army took the riskier approach because as an organization in the late 1990s, the Army was more amenable to the inherent risk in change than the Navy. The substantiation for this statement is the Army's three training centers at Fort Irwin, California; Fort Polk, Louisiana; and Hoenfelds, Germany. During the mid 1990s, the training conducted at these three bases encouraged constructive conflict and decision making at all levels. It also expected straight talk between superiors and subordinates about what went wrong and what went right during training evolutions. These discussions along with thorough after action reviews of individual and group performance created dissatisfaction with the status quo at all levels of the Army. The training experience as a whole internalized a state of mind that was a departure from the mechanistic way of thinking in all the soldiers who went through it. Soldiers began to think of radical new ways to solve problems individually and as groups and the different thought process restored the Army's "cultural vitality" [86]. The training program was so progressive that it was "…studied by the chief education officers at Shell, Sears, Motorola, and GE, and by senior delegations from every country in Western Europe, Russia, and most nations of Asia, Latin America, and the Middle East" [86].

2. The Payoff

Nobody can make the claim that the Army has had a flawless ERP implementation. In May of 2004, the GAO uncovered problems with the LMP "including such issues as failure to follow necessary disciplined processes, lack of financial system integration, and system deployment slippage" [1]. Nevertheless, the level of criticism directed at the Navy ERP program is much higher because when the systems are put side-by-side, the Army has made more progress in less time and at substantially less cost by choosing the "design then implement" approach. Both systems perform the same function for their service components. Yet, since it initiation through

Fiscal Year 2009, the Army's LMP cost stands at $1.06 billion [87]. For the same period, the Navy's ERP total cost comes to $1.54 billion [81]. The LMP went live in July of 2003 [87]. In October, 2007 the Navy's converged solution is scheduled to go live. Four years behind and close to $500 million more for the same system.

E. CHANGE OR DIE

DLA's BSM is similar to the Army's LMP in that DLA also chose to follow the "design then implement" approach and has found success with it having achieved FOC in 2006. Taking the comparison beyond this top level is not worthwhile because the BSM does not serve the same function as the LMP and the Navy's ERP. The BSM is not concerned with the acquisition of major weapons systems and the wholesale level of supply for those systems. Rather, it was acquired to secure DLA's position as the consumable supplier to the service components.

In the late 1990s, corporations such as Wal-Mart were creating value and cutting cost by eliminating central purchasing departments. Removal of such intermediary departments was made possible through the sharing of retail information directly with suppliers [88]. When viewed from the corporate perspective, DLA is a central purchasing department for the consumable parts the DOD requires. Thus, when the trend went toward ERP in the Army and the Navy, DLA recognized the possibility that if they did not provide their customers (the service components) a modern IT system to plug their ERPs into, the customers could bypass DLA and interface directly with the vendors for consumable parts. Such a scenario would eliminate the need for a DLA. This prospect gave birth to the BSM and the BSM along with the agency's ERP II initiatives has secured DLA a position in the future of DOD logistics.

F. THE BENEFICIARIES

From the Army, Navy and DLA ERP projects, both the ERP vendors and integrators gained a large body of knowledge about how to structure an ERP for the U.S. military. This knowledge has been applied to the ERP vendors' military templates and the Marine Corps and Air Force is now capitalizing on the lessons learned and investments made in the Army, Navy and DLA programs. For the Marine Corps, it took

the supply chain problems of Operation Iraqi Freedom I to drive the dissatisfaction with the current processes to a level where the Corps' leadership was forced to remedy the situation [89]. After deciding that the time had come to adopt an ERP, it appears that the Corps absorbed the lessons from the Navy pilots because the highest ranking Marine (the Commandant of the Marine Corps) is taking the position of "strong man" for the initiative. Furthermore, the Corps' transformation plan of focusing on people, processes and technology demonstrates a clear understanding that managing the change that people are going to experience as a result of the ERP is as important as the ERP itself. A commitment to changing business processes is also equally important because to work within the confines of an ERP template, an organization can not hold on to old processes. Lastly, by planning for the GCSS-MC to rely on DLA's NIMS system, the Army's LMP and vendors to manage the majority of the Marine Corps material, the Corps is demonstrating a profound understanding of the capabilities that modern supply chain management practices can deliver.

The Air Force intentionally waited to see how the ERPs of the other service components and DLA were working before making any decisions on the topic [90]. It is apparent that the Air Force liked what they saw in GCSS-MC because they are following an implementation plan that emulates the Marine Corps'. Like the Marine Corps, the Air Force has chosen the Oracle e-business suite ERP and has also elected to have a single system handle the entire supply chain from end-to-end [66]. It is an approach that has paid off for the Air Force because through Fiscal Year 2009, the ECSS system is projected to cost $694 million [70]. By waiting on the results of the other ERP projects and making the decision to have a single system control the retail and wholesale levels, the Air Force is projected to have a more capable system for a little more than half the cost of the Army's LMP and a third of the cost of the Navy's ERP.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSION

ERP in the DOD started in order to achieve compliance with the Federal Financial Management Improvement Act of 1996 (FFMIA) and fix the supply chain problems of the first Gulf War. An organization with a long-established "push" supply process was looking to institute "pull" supply processes.

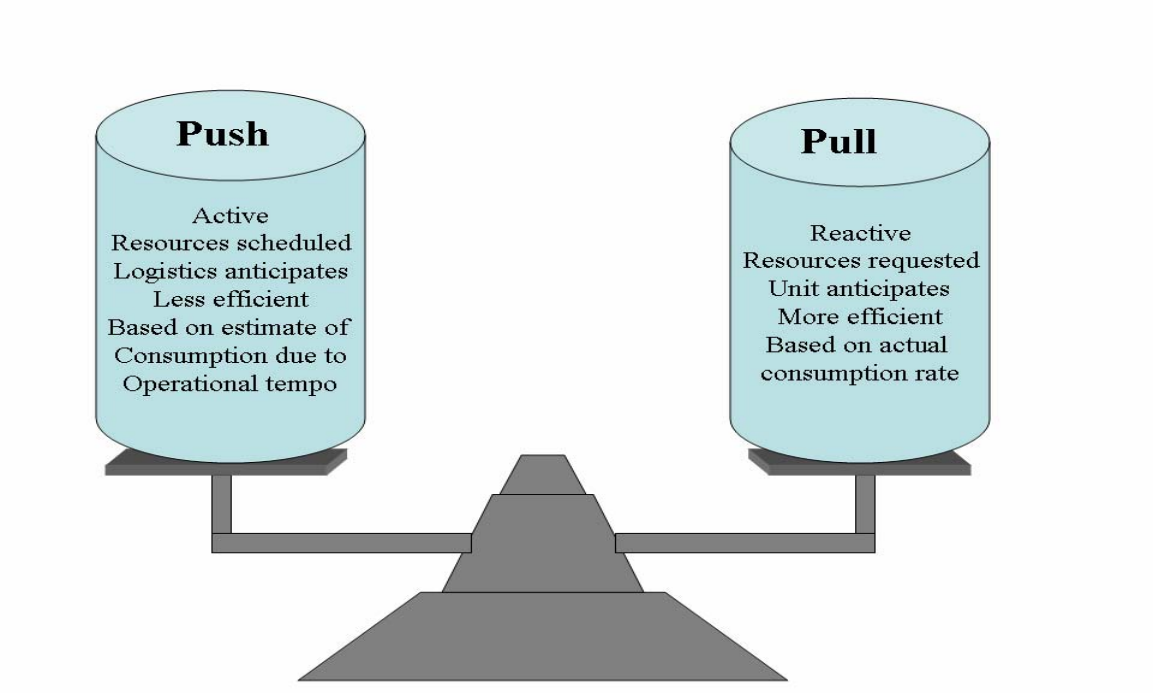

Figure 5.1. Push Vs. Pull Distribution (From: [91])

"Pull" supply chain management practices operate by the principal that the production and distribution of supplies is a single process and tremendous efficiency gains can be had by keeping inventory continuously moving. Waste is created when supplies are kept in storage. Therefore, the chain of events that must take place to get finished goods into the hands of the end users has to be integrated so that there is a minimum amount of storage at any stage. Automated Information Systems (AIS) that share demand schedules and production completion dates with every member in the supply and distribution pipeline are a critical enabler of "pull" logistics. For most organizations that operate a according to "pull" principles, the AIS of choice is an ERP [10].

Following the first Gulf War, the DOD began to recognize the enormous gains in efficiency that private sector organizations were achieving with "pull" supply chain management practices and ERP systems. However, it took the FFMIA mandate and the vision of "focused logistics" to encourage action by the Navy, Army, and DLA. This thesis examined the ERP programs of the Navy, Army, and DLA as well as those of the Marine Corps and Air Force. Additionally, an analysis of the ERP experiences of corporate organizations was conducted so that a comparison could be made between the most successful ERP implementations of the public sector and the DODs implementations. This comparison revealed that the corporations that are able to maximize the capabilities offered in an ERP are the ones that acknowledge and address the ERP pitfalls outlined in Chapter II and embrace conceptual unity amongst all the divisions within their organization. By embracing conceptual unity and establishing a true ERP "strong man", the most successful organizations are able to place the ERP in the highest possible context and integrate all departments so that data can be matched, cross-matched, and shared throughout the organization. Placing the ERP as a top-level initiative eliminates wasteful duplication and provides the organization a complete enterprisewide application.

Without an overarching framework to guide the DOD as an enterprise toward a single ERP implementation, the Navy, the Army, and DLA started their individual ERP programs. Not recognizing the common core business functions between the service components and DLA, the three organizations abandoned conceptual unity in favor of distinctive approaches to the same problem with each choosing to define itself as the enterprise. The Navy further subdivided itself and defined each individual systems command as an enterprise. By not acknowledging the fact that the organizations that have had the most success using an ERP are the organizations that put the system in the highest possible context, the DOD missed the opportunity for an optimal solution. At a time when "focused logistics" was in print as the vision for the future of DOD supply chain management, the benefits of a single ERP running all of the Department's logistics data should have been apparent. Unfortunately, this foresight was lost amongst the traditional competition between services for individual identity and a funding plan that put money at the service component level and left it up to the individual entities to figure

out the best way to implement an ERP. There is a ray of hope that the DOD is realizing the mistake it made with the recent example of the Marine Corps and Air Force using the same approach and receiving tremendous benefit from doing so. Nonetheless, even with the Marine Corps and the Air Force using the same approach and the same ERP platform, when all the service components have their systems fully operational, the DOD is going to have five stovepipes that have to be integrated to realize "focused logistics" [4].

B. RESEARCH QUESTIONS

1. What is an ERP?

An overview of what exactly an ERP system is and how it is implemented is provided in Chapter II. The analysis presented in Chapter II leads to the conclusion that despite the fact that the DOD missed a notional opportunity for an optimal ERP, the decision to use ERPs instead of custom software to transform the DOD business systems was the right choice.

a. Software Product Lines

On average, ninety percent of custom software projects in the DOD are failures. Acquiring software that has been developed using a product line architecture has a proven track record of achieving success in the DOD more than ninety percent of the time [92]. Software that has been produced using a product line architecture has a base platform from which product lines are built to capture the domain specific components of particular market sectors. For example, with an ERP, the base platform is the generic template that holds the core functionality of the system. On top of the base, domain-specific product lines such as a commercial line, a military line, and an educational line are built to market to those specific market segments. Taking the architecture one step further, each specific customer adds additional features to their product to meet specific needs that are not in the product line.

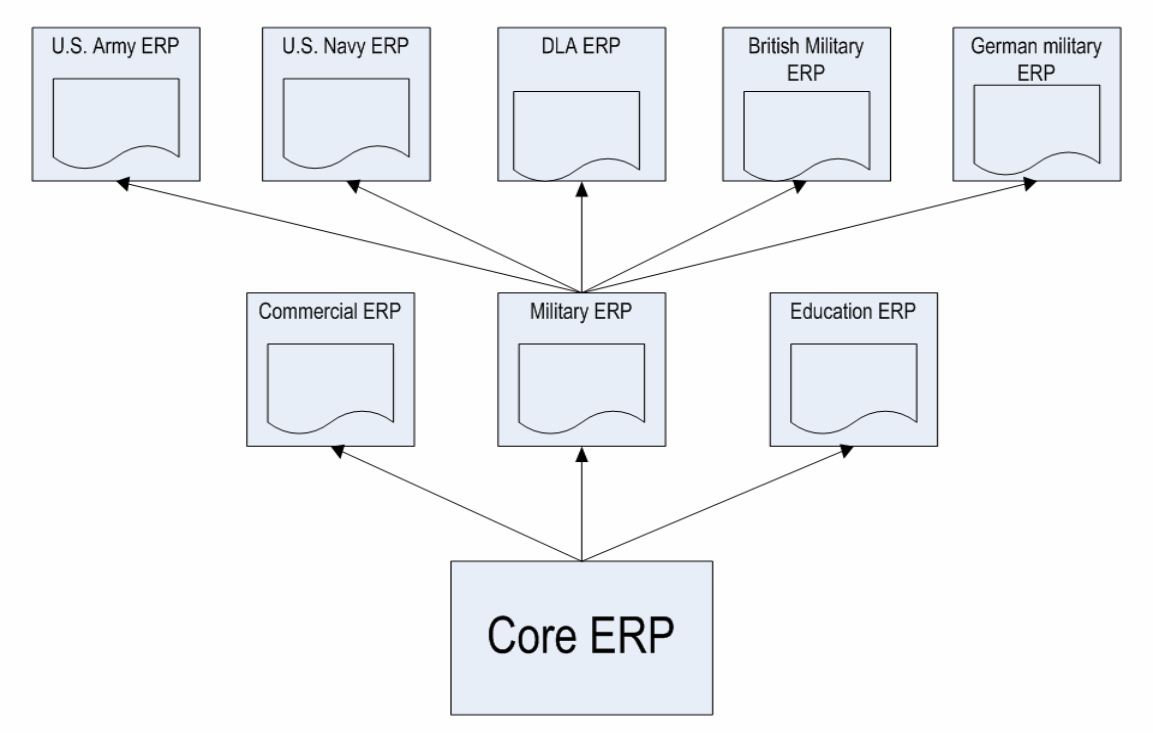

Figure 5.2. A schematic view of an ERP product line (After: [93])

The principal benefit of using product line software is that it allows for "…significant cost and effort reductions through large scale reuse of software product assets such as architectures, components, test cases and documentation" [93]. Software product lines are able to reuse software product assets by building off the core. In the case of an ERP, the core is the base template from which all product line templates are built. The cost of developing and maintaining the core is spread across all the product lines which translate into lower cost for the individual customers. Another benefit of the product line architecture is quality is improved because defects in the core only have to be fixed once. As soon as a defect is found and fixed, all the product lines receive the benefit of an improved core.

A final benefit of software product lines is that custom component additions developed for individual customers can be used by all the customers in the product line who find the component beneficial. This is important in the context of the DOD ERPs because if the German military invest heavily in an ERP feature that is important to them, but, that feature is also applicable to the U.S. customers in the product line, then, it does not cost anywhere near what it would cost if a single customer had to

bear the burden alone. Once a custom feature is developed that has a wider customer base, it can be placed in the product line (the military product line in this case) and the other customers can purchase it for a fraction of what it cost the original customer. If a feature has an even wider audience, then it can be rolled into the core and all the product lines can profit from it. Furthermore, the customers of a product line can collaborate to have a feature developed for everyone in the product line and share the cost of that feature. If each customer were using custom software that does not follow a product line architecture, this would no be possible. They would each have to pay for whatever features they want separately. This is one of the problems with the legacy systems identified by the Army in Chapter III (lack of cost sharing).

b. Established Architecture

Requirements definition and system design are the first two stages of a software development project. Software design experts confirm that "Leveraging known solutions [in the design stage] minimizes the risks that an application will fail due to an inappropriate architecture" [93]. This is the second reason that ERP was the right choice for the DOD's problems with supply chain management. ERPs have an established software architecture that has a demonstrated track record of success integrating business process to deliver the right products to the right place at the right time while at the same time accounting for the transactions properly and not having accounting functions slow the whole process down [94]. A look back at Figure 3.9 reveals that the business processes that DLA was looking to capture with their ERP are the identical processes of any intermediary distributor. Such organizations buy materials in large lots and sell in smaller lots to users whose operations do not justify large lots. Frequently, distributors act as brokers and have materials ordered by customers shipped directly from the manufacturer when the item ordered is not held in inventory [10]. By changing the wording and the pictures in the figure, the business processes of amazon.com or any other distributor would be depicted. Consequently, looking to industry to find out what IT systems were helping some of the "best in the business" perform the distribution function is the smartest thing DLA could have done.

2. By Industry Standards, What is the Optimal Way to Implement an ERP?

There are two options that an organization can choose from when implementing an ERP. The first option (the option the Army, DLA, Marine Corps, and Air Force elected) is the "design first then implement" approach. This is the option corporations choose when they have already made the decision that a switch is definitely going to be made to an ERP. It is a faster path toward implementation because there is no test of the ERP in a sector of the organization. The "design first then implement" approach follows the ERP life cycle outlined in Chapter II which starts with product evaluation and precedes into implementation phase I and phase II.

The other option an organization can choose is the prototyping approach (the Navy's choice) which involves one or two pilot projects to test the organization redesign that an ERP requires prior to translating the redesign across the entire organization. Using the prototyping approach also starts with product evaluation but in the implementation phase, only a portion of the ERP is implemented such as the operations planning function. If that function is deemed a success, then the organization will proceed to implement additional functionality.

With either methodology, the organization that will be most successful is the one that establishes a "strong man" for the project who comes from the highest level of the organization so that he can resolve the conflicts that arise between the core team members representing the different functional areas. A characteristic that the "strong man" must possess is they have to be open to the business processes that are resident within the ERP so they can ensure their organization avoids the number one ERP pitfall: overcustomization.

3. How Does an ERP Integrate Business Processes that are Not Part of the Standardized Software Suite?

The "strong man" has to be open to the business processes of the ERP primarily so they can make determinations about the necessity of old business processes. They also have to be open to the business processes of the ERP so they can instruct their team how to handle the situations where the ERP does business differently than the organization.

When this type of situation is encountered, as was discussed in Chapter II, the RICE acronym is used. Again, RICE stands for reports, interfaces, conversions, enhancements and it is the order that solutions are sought to cover the gaps between the functionality of the legacy systems and the ERP. The first option, reports will be used when the information that was produced from a legacy system can be generated as a report out the ERP. Interfacing to a system that has the essential capability is the next solution. The third option is to convert the data in the old system into a form that the logic in the ERP can understand. Finally, an enhancement of the ERP is the last option that should be used because it is a change to the core of the ERP to the way business is conducted by the organization. Despite the confusing vocabulary that suggests an enhancement is a positive action, it is not! If an organization has to resort to an enhancement, it generally means that the organization is clinging to the old way of doing things and is intending to negate the benefits of employing an ERP. Every effort should be made to prevent using an enhancement as a viable option [39].

Enhancements are different than an improvement that adds functionality to the ERP. A good example of an improvement is a custody tracking function that is needed for military customers. Adding this functionality to the core ERP because it does not exist is an improvement that can be sold to other customers in the military product line. This is added functionality. Contrarily, an enhancement takes functionality out of the core software and replaces it with software code so that the organization does not have to change the way it does business.

4. What are Experiences and Plans of the Individual ERP Programs?

The individual experience and plans of each DOD ERP program to date forms the content of Chapter III. After wasting a billion dollars on the four pilot projects, the Navy is attempting to converge the four pilots at a cost of another $800 million into a single ERP to manage the Navy's wholesale supply functions. The Navy is estimating that full operational capability (FOC) will be achieved in the Spring of 2013.

To meet the needs of the Army's wholesale supply functions, the Logistics Modernization Program (LMP) went live in July 2003 and was certified FFMIA compliant in May 2007 [87]. Currently, the Army is working on replacing the thirteen

legacy systems that manage the retail level of Army logistics with the GCSS-Army ERP. Initial operational capability is predicted to occur in October 2010 with an FOC date of January 2014 [54]. If the Army completes the GCSS initiative and merges the retail system with the LMP, the vision of a Single Army Logistics Enterprise (SALE) will be a reality. "The result of implementing the SALE is a merger of warfighter and business systems into a single, harmonious environment from the manufacturer to the foxhole, which is aligned with joint requirements" [54].

Once the Navy and the Army started their ERP programs in the late 1990s, DLA was faced with the possibility that the Agency's position as the DODs intermediary distributor would cease to be relevant if the individual services had the capacity to connect their ERPs directly to vendors and streamline the supply chain. In response, DLA started the Business System Modernization (BSM) program in 2000 and achieved FOC in late 2006. Having achieved FOC, DLA is working on extending the enterprise with some of the most promising initiatives in the DOD including the Distribution Planning and Management System (DPMS), the Integrated Data Environment (IDE), the National Inventory Management Strategy (NIMS), the Global Stock Positioning (GSP) system, and the Product Data Management Initiative (PDMI). Each of these initiatives is discussed in detail in Chapter III. When these projects are complete, DLA will be the central repository for all the logistics data for the DOD covering in-transit shipping visibility, unit location data, material stock locations, equipment technical data, and most importantly, the NIMS initiative will make DLA the owner and manager of all consumable material for the DOD.

By waiting on the outcomes of the initial ERP projects, the Marine Corps and the Air Force have been able to capitalize on the lessons learned. The plans developed by the two service components demonstrate an understanding that there is no need to develop separate ERP systems that perform the same functions. Product line software architectures like those of an ERP present an opportunity to use the exact same system with each having few additional improvements to handle the peculiarities of each service. Thus, the Marine Corps and the Air Force are essentially pooling their resources to get the best single ERP possible. FOC for GCSS-Marine Corps is anticipated in 2015 and the Air Force has set an ambitious FOC date of 2013 for the ECSS system.

5. What Are the Lessons Learned to Date that Will Assist the DOD in Achieving the Joint Vision for the ERP Programs?

Having separate ERPs within the separate services performing the same functions is duplicative. It would be more beneficial if Figure 5.2 read U.S. military, British military, German military for efficiency and cost but the figure accurately portrays reality. This by no means suggests that it was a bad idea for the DOD to use ERPs for business process transformation. The benefits of software product lines and the utilization of a proven software architecture are good justification to support the DOD's decision to go with ERP systems. Moreover, the DOD's character as a mechanistic organization discussed in Chapter IV along with the dismal record the Department has with custom software (90% failure rate) rules out any notion that custom software should have been used. Custom software may be the answer for other systems in the DOD but that is beyond the scope of this thesis. In the logistics arena, the DOD looked for industry "best practices" and that equated to ERP [94].

Besides the Navy's problems with the first two pitfalls of an ERP (overcustomization and lack of top management commitment) and the Army's problem with pitfall number three (resistance to change/lack of buy-in by the AMC programmers), a bigger problem has arisen as a result of the framework surrounding the programs as a whole. By having these separate ERPs with overlapping functions, the DOD has come to the realization that these systems are going to have to be integrated to achieve "focused logistics." In order to guarantee that the separate services work toward the vision of an integrated supply chain, the "Deputy Secretary of Defense, Gordon England directed the establishment of the Defense Business Transformation Agency (BTA) in a memorandum effective October 7, 2005" [95]. Despite being about nine years late, the BTA is the best solution for the integration problem. The BTA is the overarching agency responsible for establishing the architecture and data standards that the separate ERPs are to adhere to in order to ease the integration effort. As was stated in Chapter IV, in industry it has been proven that integrating ERPs of separate organizations is a much easier task than integrating legacy stovepiped systems. The task is even easier if there is a framework in place that specifies the data structure of the components that are going to fit together in

the framework. An institution to set up a framework and lay down the standards is the critical role that has been missing from the DOD ERP programs and it is finally being fulfilled by the BTA.

C. RECOMMENDATIONS

It is going to be more problematic for the separate programs to adhere to the BTA standards because the programs are so far along in their progress. Had the BTA been established when the programs got started it is unlikely that the structure of the ERP projects would resemble the current situation. It is probable that a central managing agency would have acknowledged the fact that at the same time the DLA first explored ERP, the Navy and the Army were also looking for a better IT system for the same logistics process.

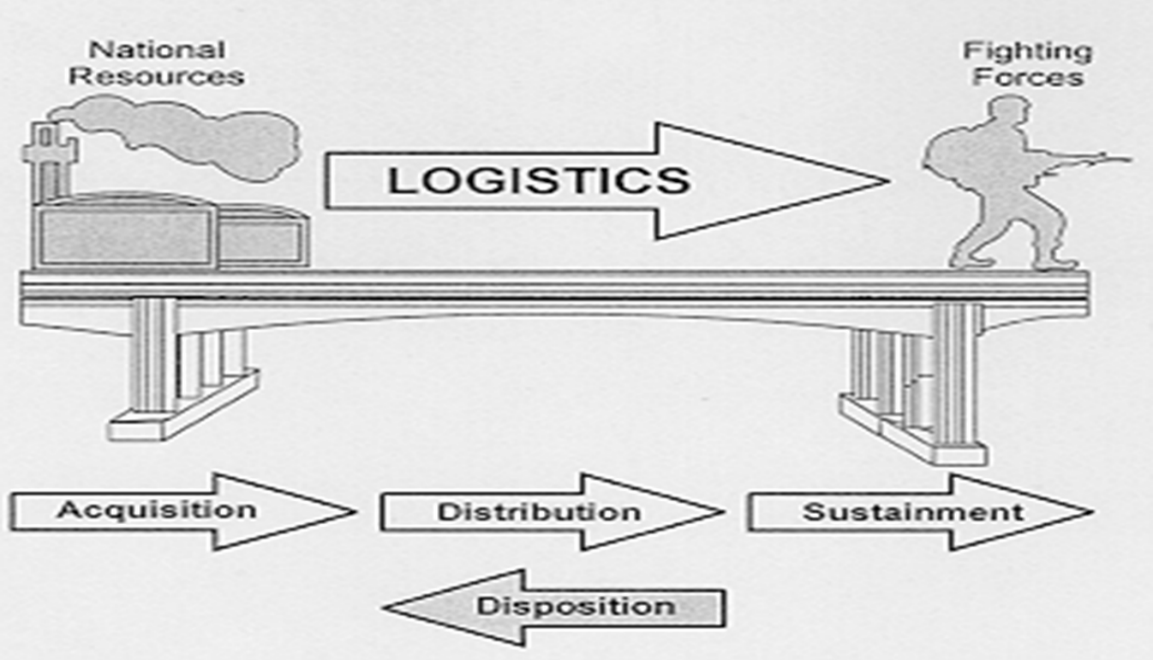

Figure 5.3. The Logistics Process (From: [91])

Chapter III emphasizes the fact that the Army's LMP and the Navy's ERP programs started to buy new systems for the acquisition and in-service support of weapons systems. At the point in the late 1990s when the first three programs got underway, had anyone looked at the DOD as the enterprise from the top down, they would have realized that the

plan to buy three separate systems to aid with distribution, sustainment and disposition was a path to three more "stovepiped" systems.

It is here where the DOD missed the opportunity to have an optimal ERP implementation. All the service components acquire major weapons systems in the same way. Therefore, there is only a need for one system to perform acquisitions. Additionally, all military equipment is maintained in the same way so there is no for separate systems to perform that function either. Therefore, it is recommended that for the supply chain management operation, after major weapons systems are acquired, the best process would be for the services to hand-off responsibility for in-service support (meaning supply) and disposition to the DLA. That is the difference between DLA as a distributor and a distributor in the commercial sector. When customers in the commercial sector order items from a distributor such as Amazon.com, the customer isn't running their own ERP. They simply link into the distributors system and order the material that is needed. As depicted in Figure 3.10, the separate service components are the customers of the DLA who is functioning as a distributor. Currently, DLA only distributes consumable material. However, there is no reason why they could not handle repairable components as well. While it would be ideal if the separate service components used the same acquisition system, it is not absolutely necessary. The greatest potential to improve the ERP programs is to have the service components keep the acquisition systems that each is acquiring in the separate ERP projects but, in-service support and disposal should be the responsibility of the DLA. Presently, the NIMS initiative is guiding the DOD in this direction for consumable material. A repairable material initiative should be started so that DLA handles the life cycle of all material from the time it comes in-service through disposal.

D. FUTURE RESEARCH POSSIBILITIES

This research focused on analyzing the lessons learned from industry that will help the DOD's ERPs be successful. Additionally, a comparison of the separate service component's ERP strategies was conducted to benchmark the programs against each other and against industry best practices to provide the DOD a reference to help the

projects in the future. Some additional research possibilities generated by this thesis but not addressed in the document include:

- How does an automatic identification method such as radio frequency identification (RFID) interact with ERPs and how will the combination of the two capabilities improve DOD supply chain management practices?
- What impact will the ERPs have on the DOD manpower structure?
- Given that DLA acts as an intermediary distributor for consumable material, what changes would have to be made within the DOD to make DLA responsible for all material, repairable and consumable?
- What are the metrics being used to evaluate how well the ERPs are performing as compared to the legacy systems they are intended to replace?

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